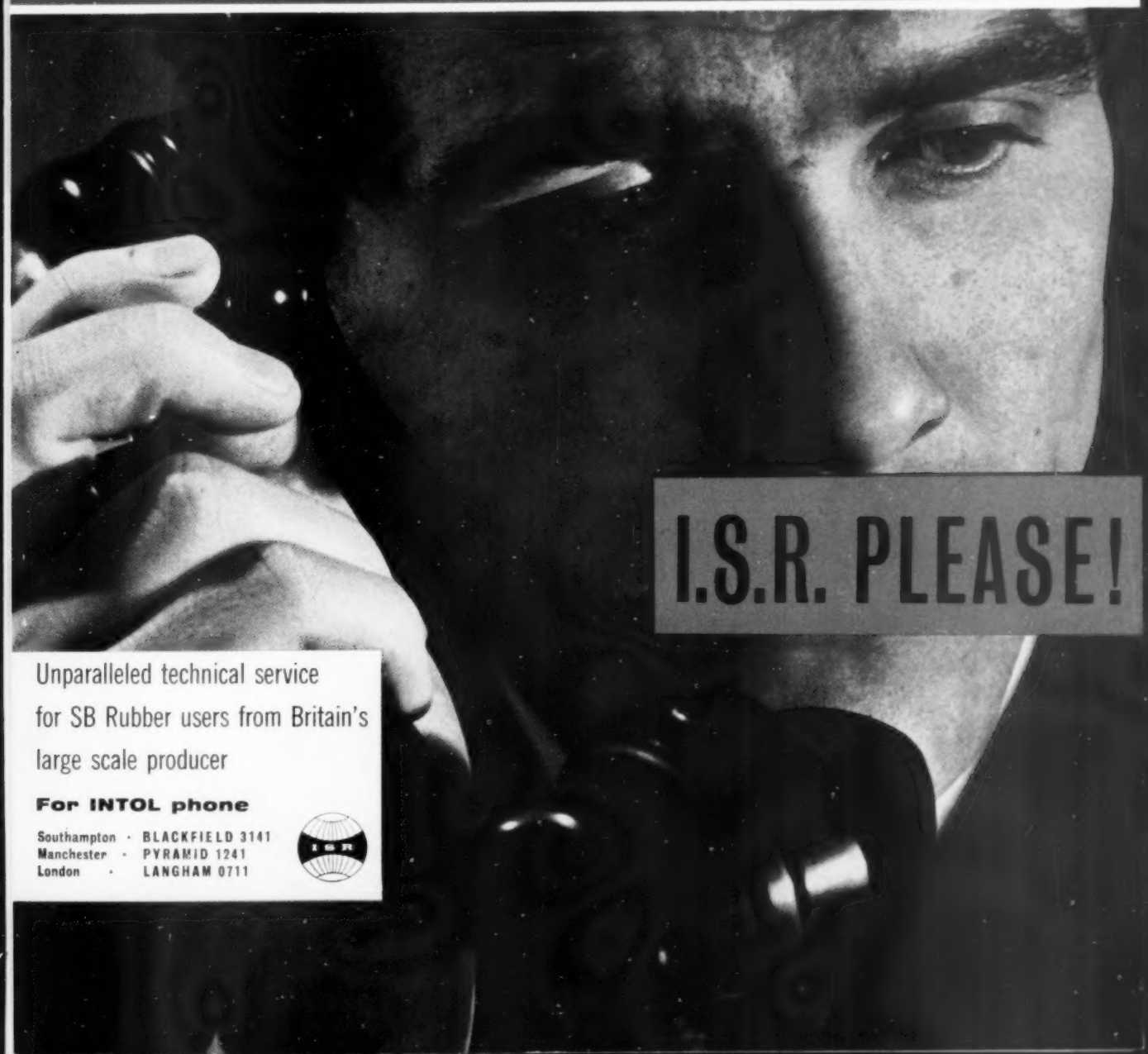
RUBBER
JOURNAL AND INTERNATIONAL
PLASTICS

One shilling — WEEKLY

VOLUME 140 NO. 8 • FEBRUARY 25 1961



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(Illustrated below)

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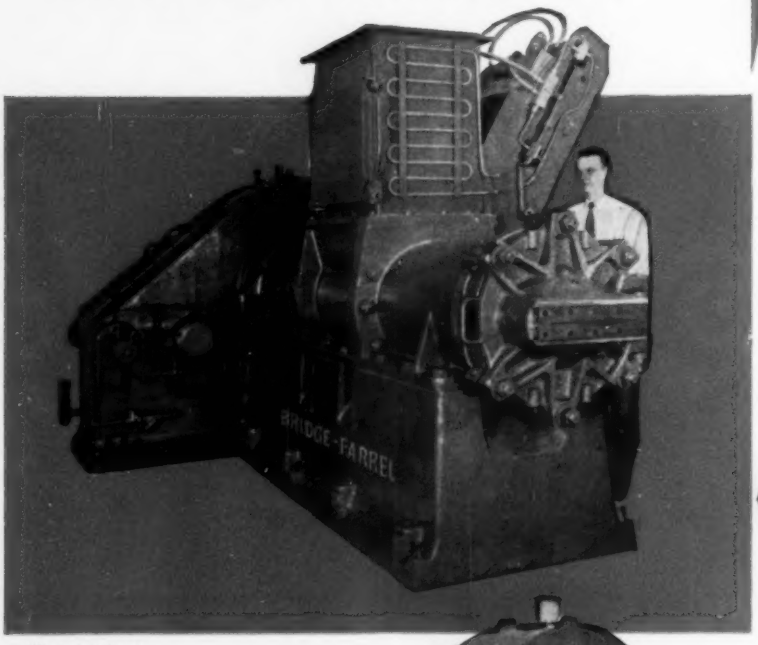

(Illustrated above)

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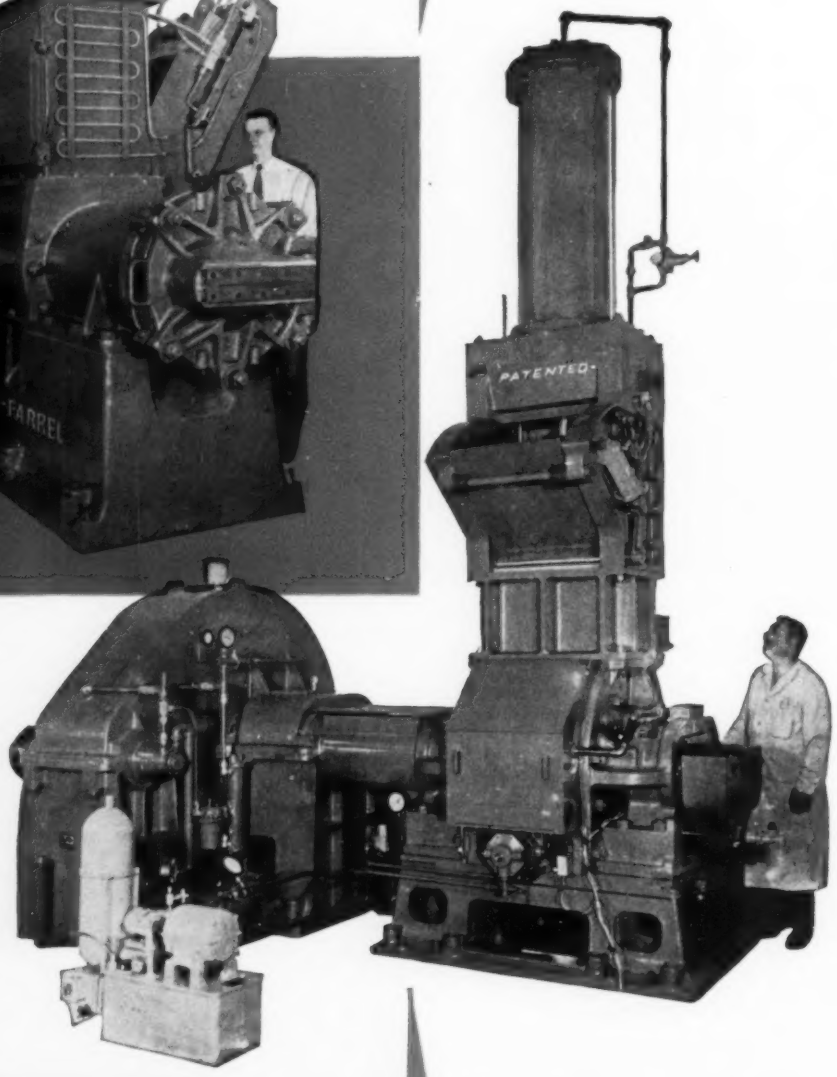

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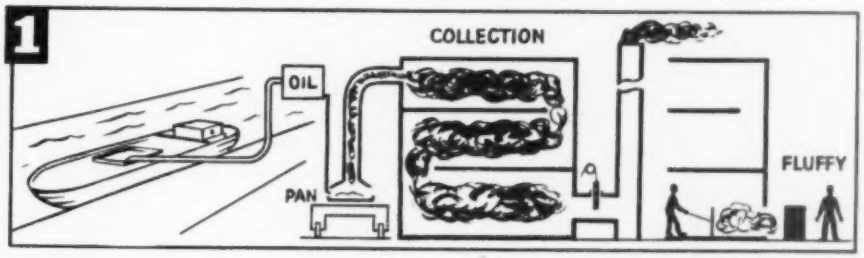
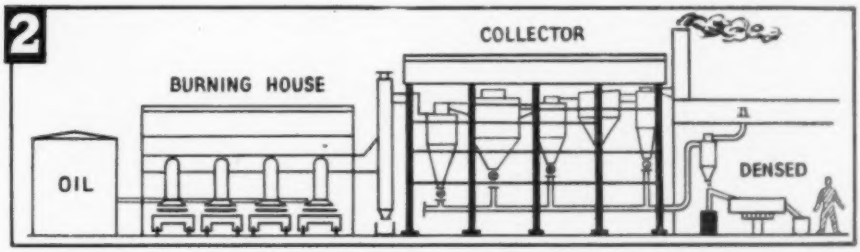
1918-53



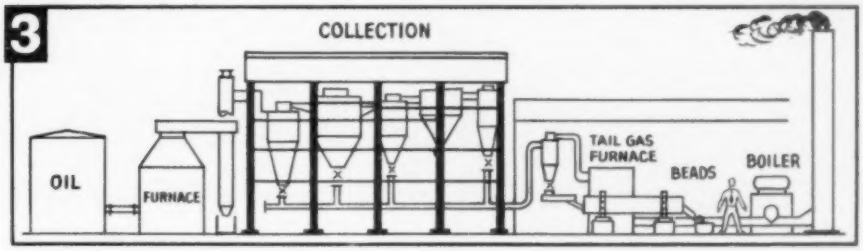
Manufacture began on the site of our present works at Four Ashes in 1918. Coal Tar distillate oils were delivered by canal barge and were burned in a cast-iron pan under a bell-shaped hood. Smoke passed 600 feet through a series of tunnels to be deposited on the floor of a settling chamber. Once each 24 hours the process was halted while men entered the settling chambers to extract and bag the fluffy black in hessian sacks.

1953-57



Early in the '50s the gravity process was abandoned in favour of a modern 8-Pan Collector Unit embodying cyclones and an electrostatic precipitator. Pneumatic Conveyors now carried the product which was, at this point, available as a densed or fluffy powder.

1957



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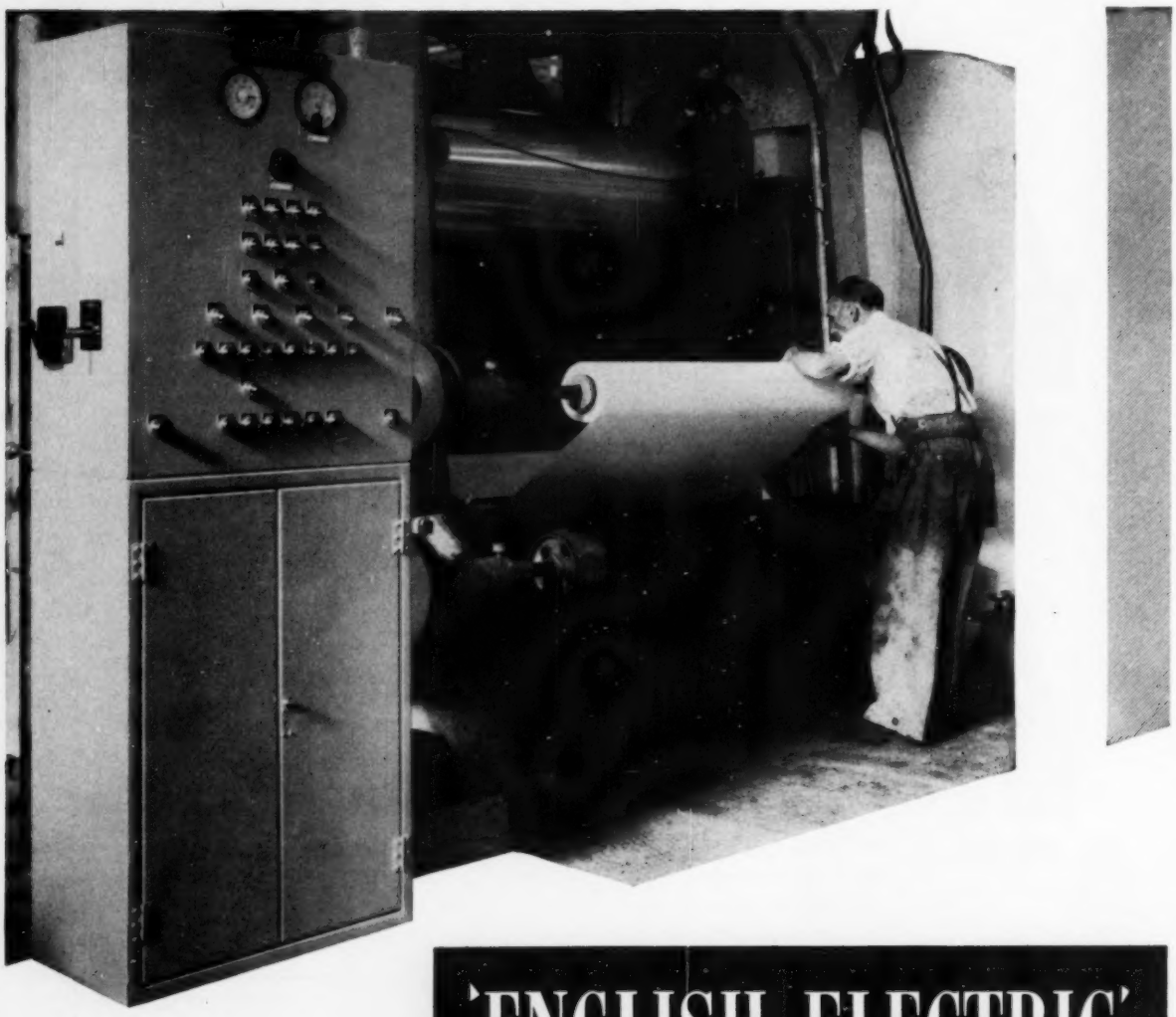

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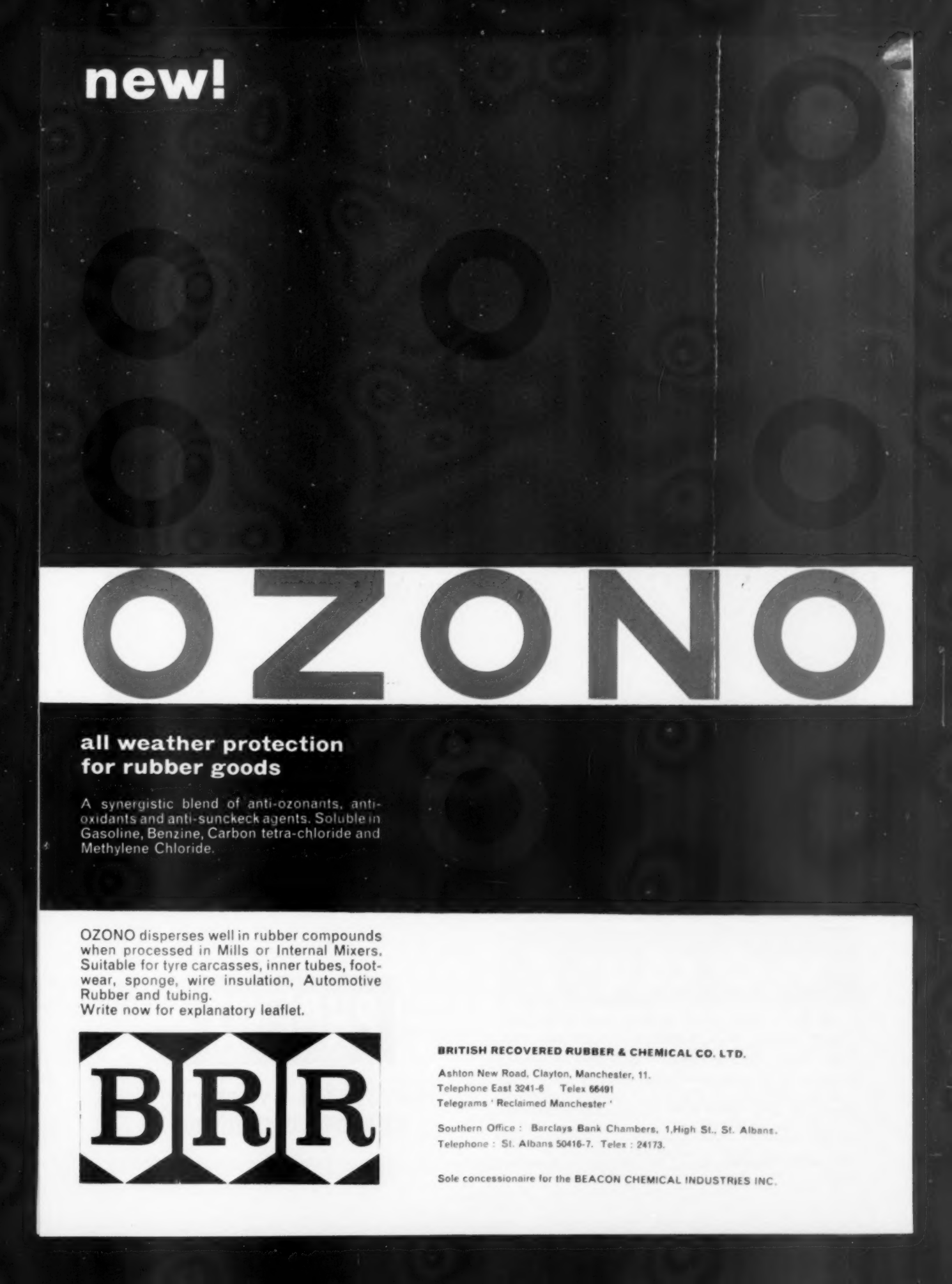
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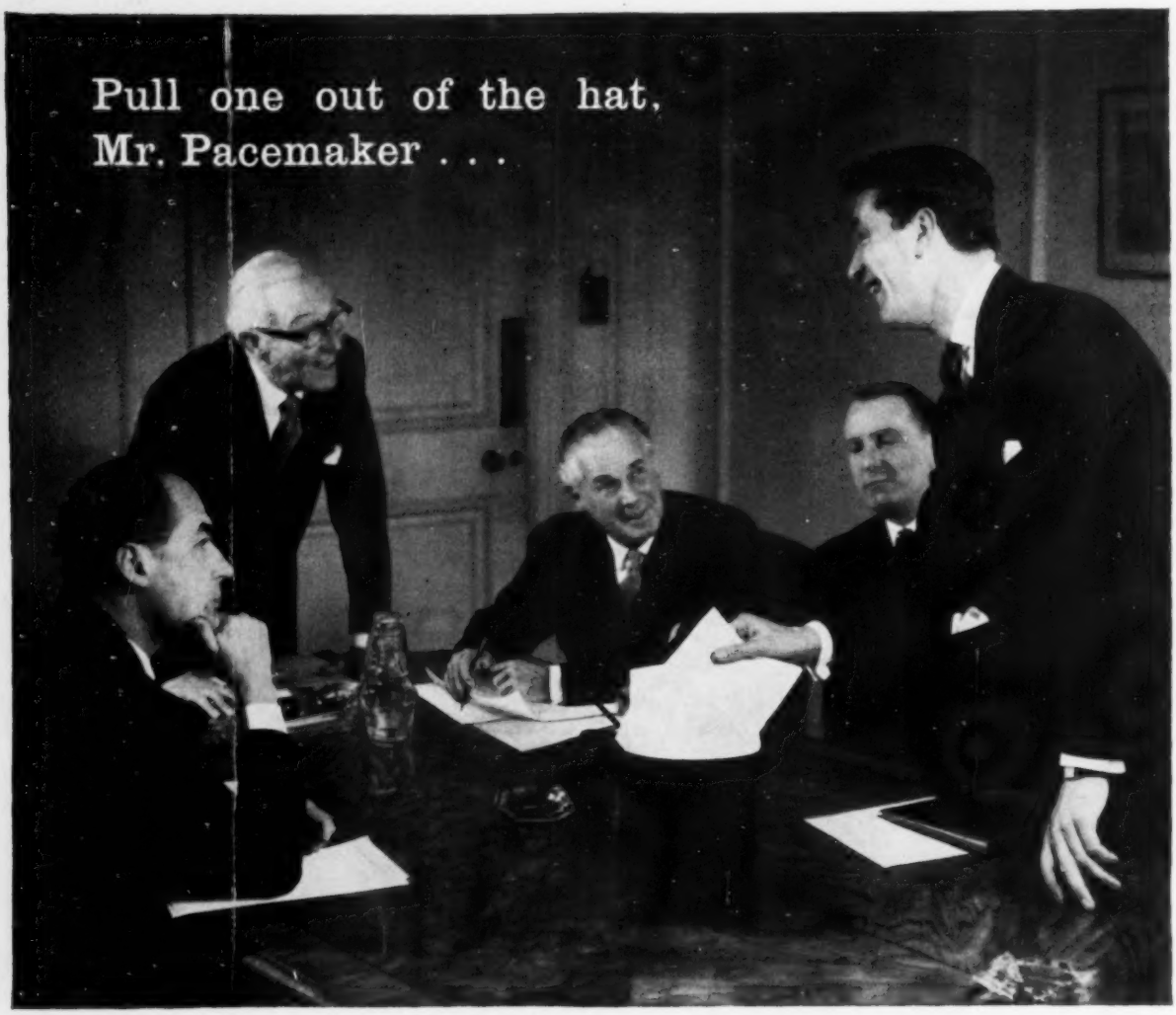

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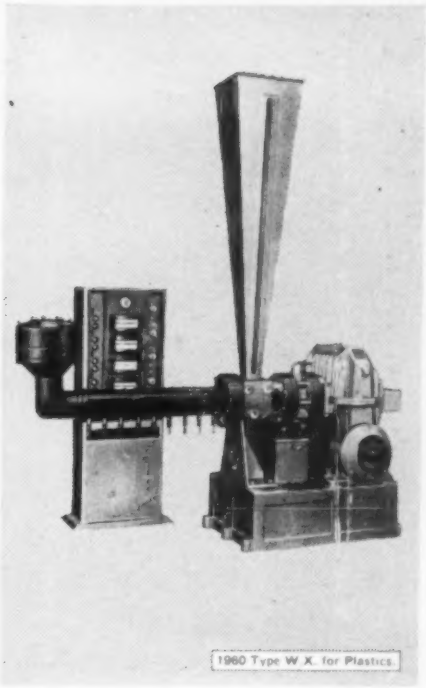
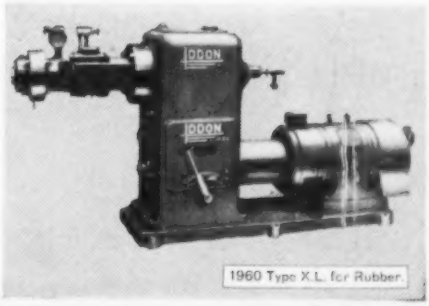
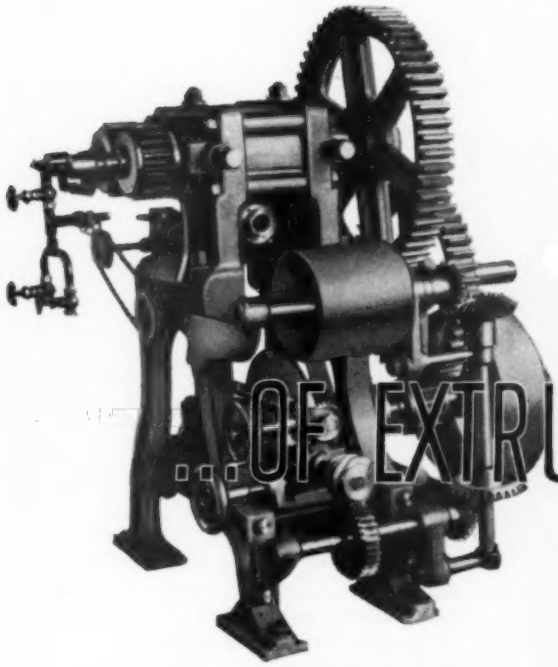


1960 Type W.X. for Plastics.



1960 Type X.L. for Rubber.



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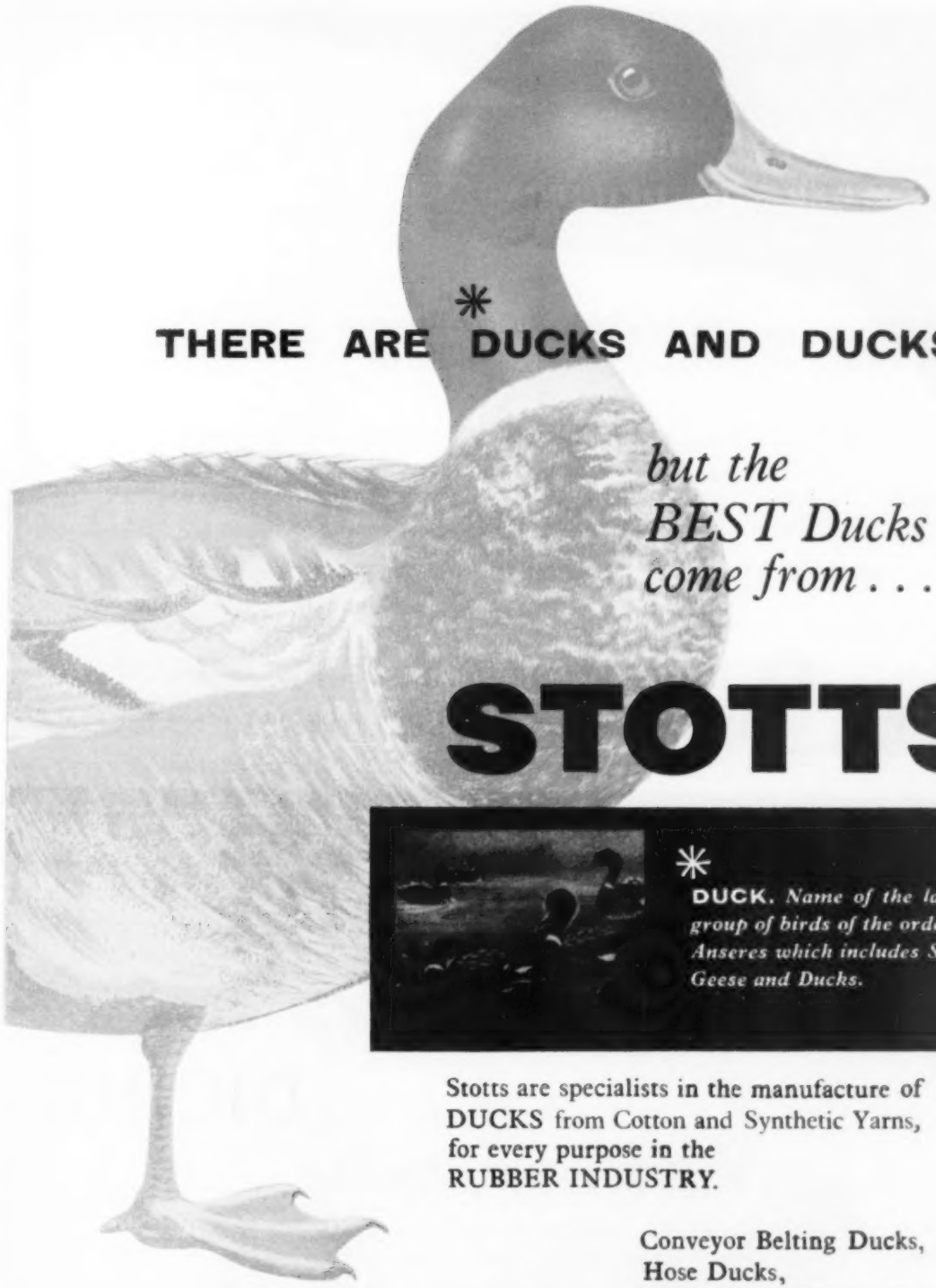

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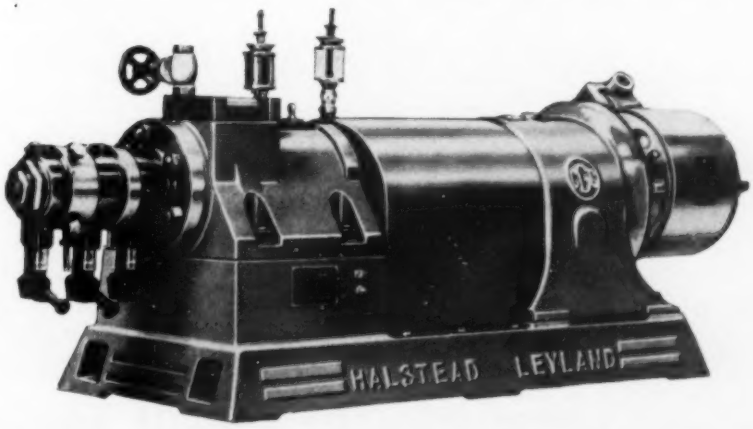

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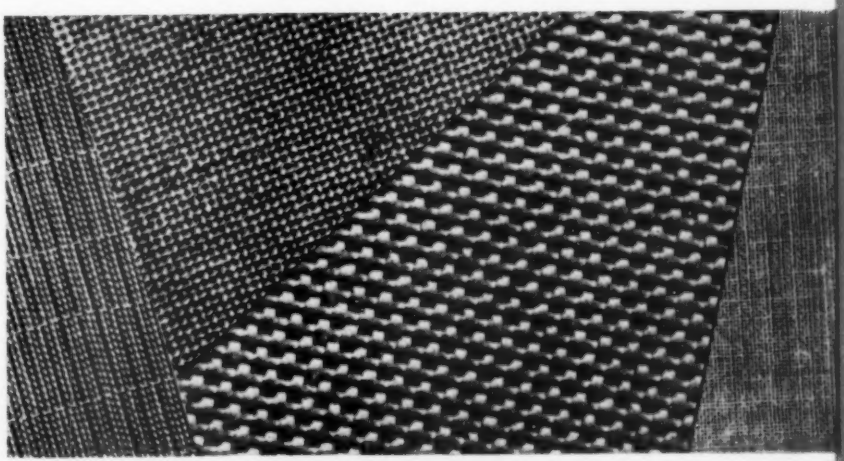

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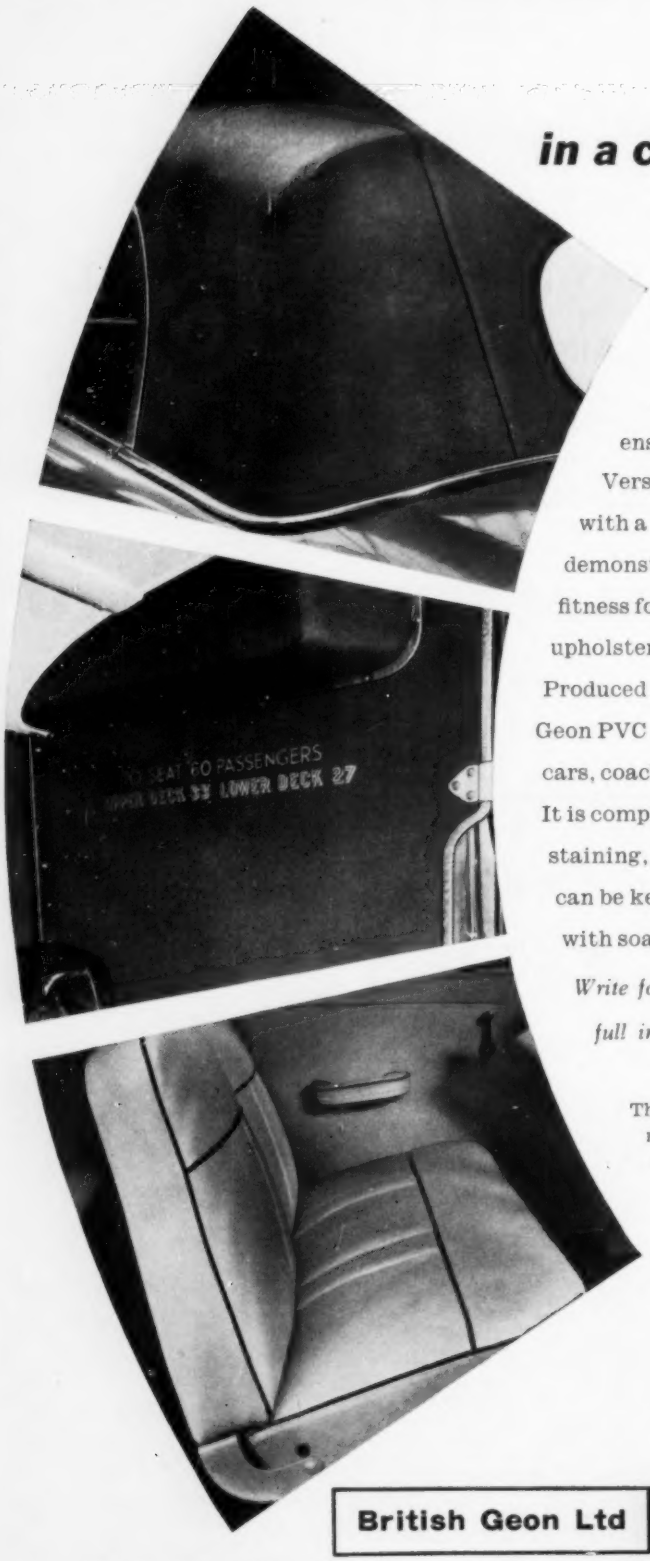

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One shilling — WEEKLY

Volume 140 — IN ITS 77th YEAR — No. 8

February 25 1961

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NOTES of the WEEK

Supplement on Transport

THE growth of all forms of transport and the development of the polymer industry have to a certain extent been interdependent. Without cars the rubber manufacturing industry would not have reached its present important position. Without rubber the car industry would have been ' grounded ' from the start. Plastics also have become indispensable parts of modern vehicles—forming anything from car dashboards to the nose-cones of rockets—and in some applications, such as heavy trucks and small boats, they may form a major part of the body structure.

In order that rubber and plastics manufacturers can keep up with current trends in transport, *RJIP* has prepared a special supplement on the subject which appears in this week's issue. Naturally it is impossible to deal with all aspects of such a vast subject, but we have attempted to give as broad a cross-section as possible—covering topics from the effects of the current ' recession ' on component manufacturers to the welding of pvc car seats.

More Profit from Less Products

DO you make too many products? Analysis of figures of a number of firms of all sizes has shown that a large proportion of the profits of a firm frequently come from a small proportion of its products. If customers' requirements are standardized, then it is often found that the number of products manufactured can be sharply reduced. Paring down of the range means longer production runs for the more popular products, with a consequent increase in productivity. Such a paring down obviously has to be done very carefully, with the greatest possible liaison between the sales, technical service and production departments.

One firm, manufacturing resin glass-fibre pipe wrapping, found an opportunity for standardization with the building of a new plant. The problems were that customers requested a very wide range of wrapping thicknesses, from 0.01 to 0.2in., and that the use of 13 types of binder was leading to production hold-ups. Changing the binder meant stopping the plant for an hour to clean out the emulsion system and to introduce the new binder. This happened several times a week. Investigations by the sales department showed some binder types were rarely sold, and then only in small quantities; while the technical service department found that these binder types could, in most cases, be replaced by the more popular binder types. The cutting out of eight of the 13 binders, and a standardization of wrapping thicknesses, led to an increase in plant efficiency of 10%.

The British Productivity Council issues an excellent book on variety reduction, which contains 12 case-histories demonstrating the benefits to be obtained from this technique by both small and large firms. Firms that have tried variety reduction stress that it is far from a matter of persuading a customer to fit a square component into a round product. It is a recognition of uneconomic variety and, in fact, contraction of the range, far from displeasing a customer, often leads to giving him a better—and quicker—service.

Development Areas

CHRYSANTHEMUMS and carnation cuttings are growing next to rubber seals; not far from a steel rolling mill polystyrene is expanding. This odd assortment of activities is taking place on the Marsa Industrial Estate, Malta. In the past year 16 industrial projects have been set up there, and some of the factories are already in production. The capital involved is small by European and American standards —the current five-year plan aims to spend £2m. on factory building—but the scheme is significant as an example of the speed with which a comparatively neglected area can be developed. In three years' time the industries already approved will be providing employment for over 3,000 people.

Compared with our under-planned, overcrowded and over-taxed island the business man finds many advantages in such an industrial area: planned factories, tax concessions, no labour problem—and plenty of room.

A development area nearer home is Northern Ireland. Here again, rubber and plastics firms have been among the first to establish new industries in the area. For its first European plant Du Pont chose to make neoprene at Londonderry, I.C.I. is building a Terylene plant at Kilroot, and there are a number of smaller projects.

The problem in the polymer industry is often not whether to expand, but where to do so. For a medium-sized firm moving a considerable distance to a development area seems such a big step to take that it is often not considered at all. Lord Chandos has pointed out that in the minds of some business men Northern Ireland is further away than Stockholm or New York. ' Yet in that country, a couple of hours' journey from boardrooms where obstacles to development are often discussed, there exist opportunities for growth to be found nowhere else in the UK.' The opportunities are at least worth investigation.

NEWS *Briefs*

US POLYPROPYLENE CAPACITY—SOVIET ORDER FOR UK—NEW ACETAL COPOLYMER—RHODESIA RAISES TYRE DUTY—THIOKOL'S BUTYL PLANT

●**United States** — Texas Eastman Co., a division of Eastman Kodak, has started large-scale production of polypropylene at Longview, Texas. By mid-year the plant is expected to reach its capacity of 20m. lb. a year. An Eastman spokesman estimated that domestic production of polypropylene in 1960 totalled 40m. lb. and predicted that by the end of 1962 Eastman and other companies will have a capacity for 460m. lb. of polypropylene.

●**Australia** — An oil refinery costing £A7m. is to be built in Brisbane by Amoco Australia Proprietary, the refining and marketing subsidiary of Standard Oil of Indiana. Commercial operations are to begin before the end of 1966 and the production of petrochemicals is being investigated.

●**United States** — National Distillers and Chemical Corp. will begin construction this spring of a 60m. lb. a year linear polythene plant adjacent to the company's conventional polythene plant at Houston, Texas. The new plant, which will mark National's entry into the manufacture of linear polythene, is scheduled for completion in the fourth quarter of 1962. National's present facilities for conventional polythene have a rated capacity of 300m. lb. a year.

●**India** — East India Plastics (India) Ltd. opened its first plant in Bengal recently. The plant is the first large unit in India to compound plastic moulding powders. The company has also made arrangements with certain foreign firms for the manufacture of cellulose acetate flakes. It is expected that construction work on this project will be started in about a year's time.

●**United States** — The Navy Propelland Plant at Indian Head, Maryland, has awarded a $20,000 contract to B. F. Goodrich Industrial Products Co. for a 'unique material which insulates against intense heat.' This material, called Pyrolock, is applied as a protective coating to interior surfaces of rocket booster cases.

●**Rhodesia** — The Federal Government has announced in Salisbury increased import duties on certain sizes of car and truck tyres and tubes. The additional duty of 2s. 6d. per lb., covers the production of the Rhodesian factory of Dunlop Ltd. Excluded from the new duty are tyres and tubes for tractors, earth-movers, motor cycles and cycles. Goods already in transit to the Federation will be charged with the old tariff.

●**Sweden** — Superfosfat A/B is expanding its plastics production side. It is to increase its PVC output by more than 50% to 25,000 tons a year by the end of next year. The firm is also co-operating — with Union Carbide — in the polythene plant which is being built at Stenungsund. This plant will be fed with ethylene by the new Svenska Esso refinery.

●**Turkey** — The foundations of the Pirelli tyre factory have been laid near Istanbul. Output will be 120,000 tyres and inner tubes to start with, rising to a capacity of 250,000. The factory will cost $2.5m.

●**Denmark** — Scandiflex A/S has started production at its new plasticizer plant, which plans to supply phthalates and adipates for PVC. Capacity is said to be 5,000 tons.

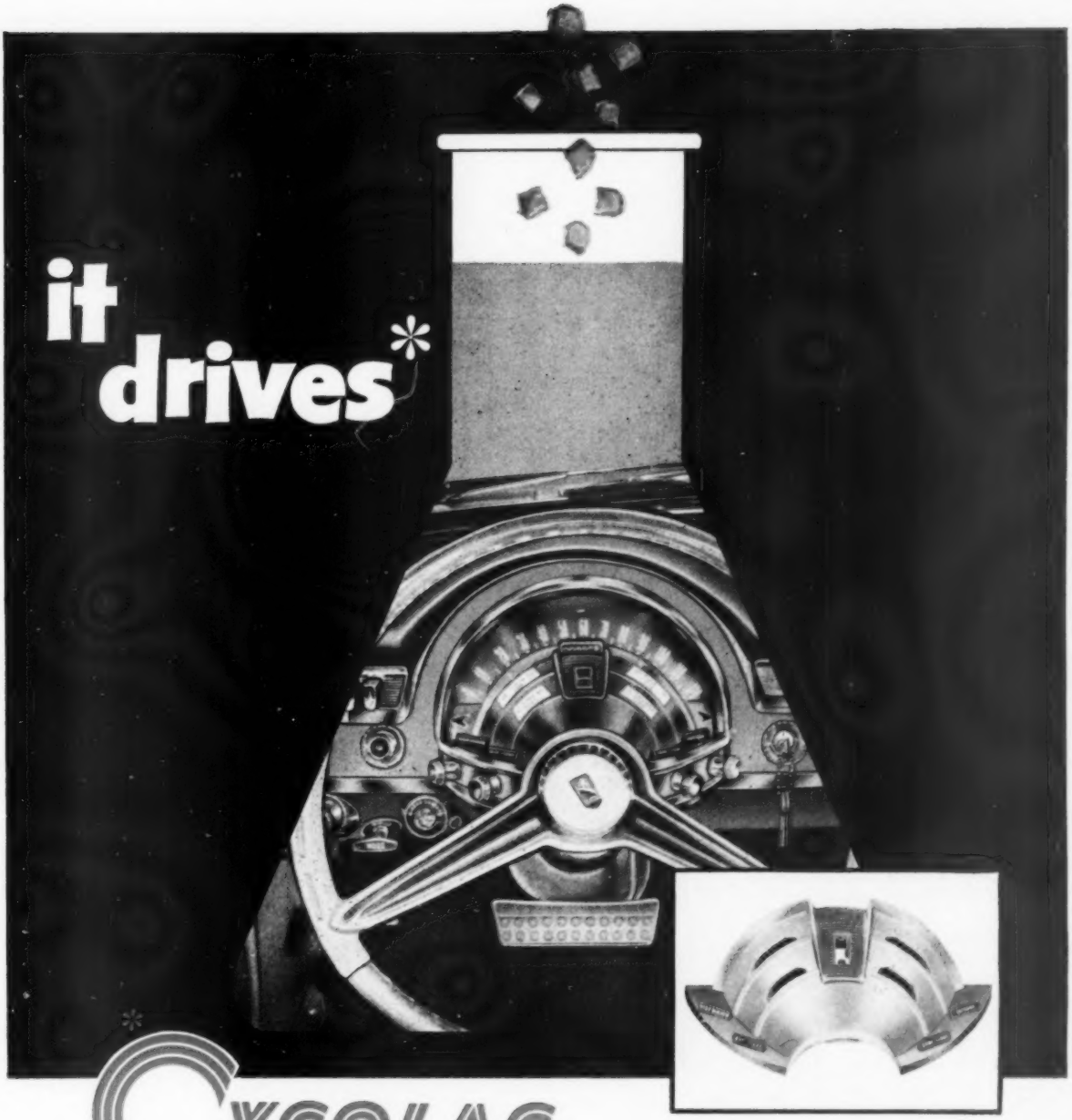
●**United States** — Thiokol Chemical Corp.'s long-range plans contemplate a 'mix' of approximately 80% military and 20% commercial business by 1965, compared with 90% military and 10% commercial at present, according to J. W. Crosby, the president. One of the programmes under active consideration was said to be a joint venture with the Cities Service Co. to build a butyl rubber plant. Engineering studies were nearing completion and a decision whether to go ahead was imminent. Mr Crosby said Cities Service would probably have the larger interest in the programme, which might involve a capital outlay of some $25m.

●**Canada** — Shawinigan Chemicals Ltd., Canadian resins division, has been appointed distributor for Marlex high density polythenes, ethylene copolymers, and tailored resins made by Phillips Chemical Co., Bartlesville, USA. Shawinigan's head office is in Montreal.

●**Russia** — A contract for £500,000 worth of automatic bag filter plants for carbon black has been secured by Tilghman's of Altrincham, Cheshire. Half of the plants will be supplied to the Dniepopetrovsk tyre factory, and half to a factory at Rostov.

●**United States** — The Celanese Corp. of America has announced the development of an acetal copolymer to be marketed under the trade name Celcon. Production has begun at the Celanese facilities at Clarkwood, Texas. The company expects Celcon to replace light metals in a wide range of applications.

'— all opposed, say "I resign"'— 525



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Plastics Policy in EFTA

GROUP ESTABLISHED BY TRADE FEDERATIONS IN THE SEVEN

REPRESENTATIVES of plastics industries in EFTA countries have agreed to establish a policy committee to present a single view to their Governments on tariffs and relationships with the Common Market. This was decided at a meeting last week in London (*RJIP*, Feb. 18, 253).

The policy committee would appoint study groups on subjects such as rules of origin, said David Radford, chairman of the British Plastics Federation and chairman of the EFTA meeting.

It was stated that the first study group would report back to the policy committee not later than its next meeting in London, which would be at the time of the International Plastics Exhibition in June. If Finland becomes associated with EFTA, it was added, the committee would invite Finnish delegates to attend the June meeting.

Speed of Tariff Reduction

There was some disagreement among delegates on the speed of duty reduction within the Seven. The UK delegation, with Swedish support, pressed for fast tariff reductions within EFTA. This move was opposed by delegates from Norway.

The meeting supported the suggestion that the link with CEFIC (Centre Européen des Fédérations de l'Industrie Chimique), which discusses plastics as chemicals, should not be weakened, but that the view of the plastics industry should be put forward independently since that industry consisted of the plastics material manufacturers, machinery manufacturers and processors.

Giving the view of the British Plastics Federation, A. Renfrew, chairman of the BPF overseas trade committee, said that although plastics were important materials, exports from the UK in 1959 amounted to only £40m.— 1.3% of the total UK exports and about 10% of the chemical exports.

Importance of EFTA Market

The EFTA market for plastics was important, he continued, since the population of the countries was about 90m. The population of the Common Market was, however, about 170m. If the two groups were to be united, their sales of plastics would be almost as great as those of the USA. Industry in Europe as a whole was growing at a higher rate than in the USA, said Mr Renfrew, and the only other industrial countries in the world in which the rate of growth was higher were Russia and Japan.

Mr Renfrew pointed out that 36% of UK exports of plastics raw materials went to EFTA and the Common Market, whereas 65% of West German plastics went to those territories. The difference in the pattern of trade was striking, he stated. In 1959 the distribution of plastics exports from the UK was roughly 20% to the Common Market, 20% to EFTA, 30% to the Commonwealth and 30% to the rest of the world.

Mr Renfrew said that he did not wish to suggest that this pattern of business was in any way permanent. The percentage of exports going to the EFTA countries had been increasing, while the percentage going to the Commonwealth had been decreasing. The rate of increase in sales to the Commonwealth had been well below the rate of increase in sales to EFTA.

Striving for Self-Sufficiency

One cause, Mr Renfrew indicated, was that the countries of the Commonwealth were establishing their own plastics industries in conformity with the pattern in highly industrialized countries. Every country in the world, however small, seemed to be striving for self-sufficiency in plastics for reasons which he regarded as psychological rather than industrial.

After dealing with the objectives of EFTA, Mr Renfrew said that agreement had been reached on the Rules of Origin. The standard rules, however, had been already amended in the case of Section 39.02 (Thermoplastics) to allow an accounting method, since there had been technical objections to mixing physically polymers from EFTA and non-EFTA countries. This rule was due to come up for review in December 1961 when, Mr Renfrew thought, it might be enlarged to include thermosetting resins. The conflicting interests could not be resolved at inter-government level and discussion between the EFTA plastics organizations seemed to be indicated.

USA's Position

The very advantageous situation enjoyed by the USA could be exemplified by the tariffs for one product, polythene, Mr Renfrew stated. In the UK the import duty was 10%; in the USA the import duty was 39%, which was very much higher than the ultimate Common Market import duty of round about 20%. 'It can be argued that the American fabricators are prevented by high tariffs from purchasing raw materials at a competitive world price,' he continued. 'We in the UK believe that these facts cannot be emphasized too frequently. In 1959, 34% of the US exports in plastics went to the UK and the Common Market, whereas the total exports of the UK and the Common Market to the USA were 2.5% of the total. It seems very strange that the USA plastics industry wishes to shelter behind such a prohibitive tariff.'

Strike at India Tyre

DUNLOP WORKERS STILL OUT AT SPEKE

ABOUT 800 of the 1,100 rubber workers at the factory of the India Tyre and Rubber Co. Ltd., at Inchinnan, Renfrewshire, went on strike on February 21 in support of the strikers at the Dunlop Rubber Co.'s factory at Speke, near Liverpool.

India Tyre said it had done 'everything in its power to prevent an unofficial strike taking place.' The rubber workers had withdrawn their labour 'for no valid reason and in defiance of trade union advice. Engineers, site workers and other personnel will continue to work, and efforts will be made to continue the delivery of tyres to customers.'

The strikers' action was 'improper, unconstitutional, and damaging to both the factory and themselves.' The management deplored this course in view of the need to ensure stable employee-employer relations in Scottish industry.

More than 3,000 workers at Speke have been on unofficial strike for two weeks, in support of a demand for payment at piece rates to 150 people in the sports department for work lost during alterations.

Because of a shortage of materials processed at Dunlop's Speke plant about 530 workers at the same company's factory at Walton, Liverpool, have been laid off.

Talks are going on between the management and officials of the National Union of General and Municipal Workers about a four-day week for the remaining 750 workers.

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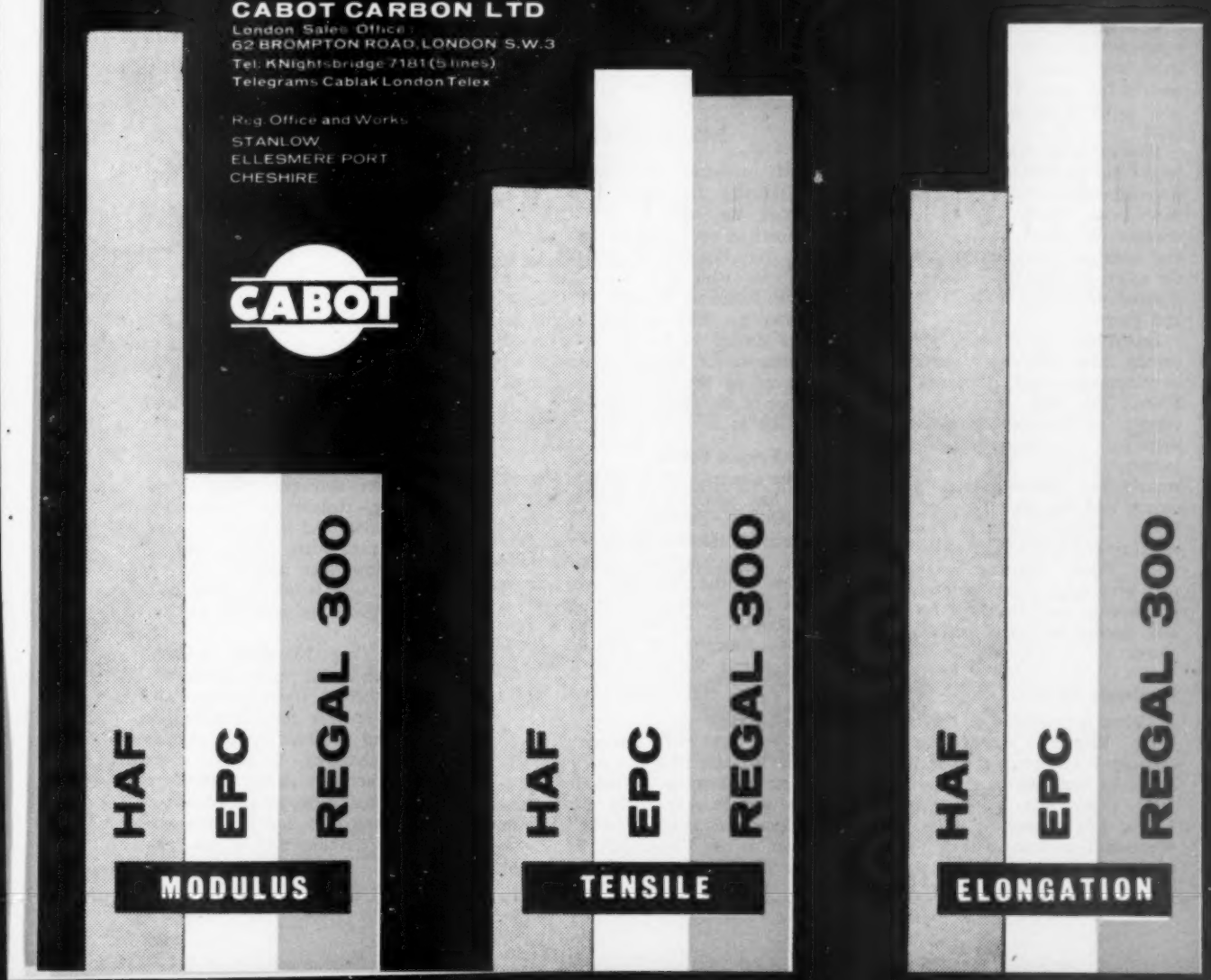

Delrin Price Slashed

SUBSTANTIAL CUT WILL BROADEN MARKET

THE reduction of price in Du Pont's acetal resin Delrin, which becomes effective from March 7, is by far the most significant of the three reductions in price which have been made since the product was first marketed just over a year ago. The price of the natural resin is to be reduced from 6s. 5d. per lb. to 5s. 2d., a cut of almost 20%.

At this new price, on raw material cost alone, Delrin is almost exactly equal to zinc die-casting alloy on a price/volume basis and approximately half the cost of brass.

The relatively simple method of producing finished components by injection moulding, resulting in precision parts which require little or no finishing operations, can swing cost considerations still further in favour of the plastic rather than the metal.

Competition With Metals

It is thus expected that Delrin will compete primarily with metals rather than with other synthetic materials and, in fact, over 80% of the polymer used in USA during 1960 was in this field.

Plastics with which acetal resins might be expected to compete are polycarbonates and nylon. At the new price Delrin is considerably cheaper than both of these materials and could capture some of the market for nylon in general domestic and industrial mouldings and for bushings and gears.

Introduced in January 1960 following 12 years' research and development, and the outlay of $50m., the resin represents a new concept in thermoplastic engineering materials. Its combination of properties bridges the gap between metals and plastics, as it is very strong and has high rigidity without being brittle, high dimensional stability and a low coefficient of friction. These properties are retained to a very large degree under adverse temperature and humidity conditions and during extended periods under stress.

Dordrecht Plant

Delrin is produced at Parkersburg, West Virginia, where the plant capacity is estimated at 30m. lb./year and is expected to reach 100m. lb. by 1965. A plant for processing Delrin for use by the entire Western European market is at present under construction at Dordrecht, Holland, on the site of Du Pont de Nemours (Netherland) NV, and production operations are scheduled to begin later this year.

The company also has plans for the building of a plastics design laboratory in Geneva, the main purpose of which will be to assist European manufacturers develop new applications, primarily for Delrin and Teflon fluorocarbon resins.

A wide range of mouldings have been successfully made from Delrin. Of these, one of the most interesting is a dashboard instrument cluster housing — one of the largest Delrin mouldings in production.

This is an excellent example of the way in which acetal resin can replace a metal, as the cluster (which weighs 2lb.) is used in place of a 9lb. zinc die casting and requires considerable structural strength, as the moulding is called upon to anchor, suspend and display nearly 8lb. of instruments and fittings.

REVERTEX TO BUILD LATEX PLANT

Revertex Ltd. is planning to build a synthetic latex factory near Grimsby. This will be run by a jointly-owned company to be formed by Revertex and the International Latex Corporation of Dover, Delaware, USA.

A wide range of latices will be produced by the plant, which will be constructed on a 60-acre site at Stallingborough on the Humber Bank. An industrial development certificate for the project has been granted by the Board of Trade.

Rights Issue Proposed

Revertex is proposing a one-for-five rights issue. Figures for the year ended September 30 1960 show that the company is increasing its dividend from 27½% to 32½%, with a final of 20%.

Profits increased from £415,433 to £462,418 and, after UK and South African tax, the net profit of £252,418 compares with £223,333 in the previous period up to September 1959.

PI News

Searching for Plastics History

THE trustees of the Plastics Industry Education Fund have awarded the sum of £450 to M. Kaufman to assist him in his research into the history of plastics. Mr Kaufman, who is a senior lecturer at the National College of Rubber Technology, will use the money to travel abroad in search of historical information for the publication being prepared by the Plastics Institute in honour of the plastics centenary celebrations to be held in May 1962.

First Female Fellow

The Council of the Plastics Institute has awarded a Fellowship to Dorothy M. Farmer. Dr Farmer is librarian at the British Plastics Federation, and becomes the first lady Fellow of the Institute. Associateships have been presented to P. G. Frankland, E. L. Hill, F. P. Hiron, J. W. Murphy, W. Titow, A. J. Wilson and R. A. Wynn. D. H. Heathcock has been awarded a graduateship.

FBI President at PI Dinner

Sir William McFadzean, president of the Federation of British Industries, will be responding to the toast of the guests at the Plastics Institute dinner at the Connaught Rooms on June 27 1961. As already announced, Lord Birkett will be proposing the toast of the Institute.

Membership

The total membership of the Plastics Institute is now over 3,600 individual members.

New Polymer Rubber

Polymer Corporation has developed a new oil-extended rubber called Polysar Krynol 654. The company regards this as a considerable advance on other oil-extended rubbers.

The rubber has been developed especially for easy processing. It is non-staining, requires no breakdown prior to mixing, and is said to be easy to process even when heavily loaded. There is low heat build-up during the mixing, and faster extrusion and lower die swell are claimed for the rubber.

Polymer Corp. has done considerable research on the processing behaviour of synthetics. Investigations have been made on how gel formation can be inhibited without using special mixing techniques, and on what factors in polymer design contribute to the quicker incorporation of fillers. The company says that this research led to the development of the new grade.

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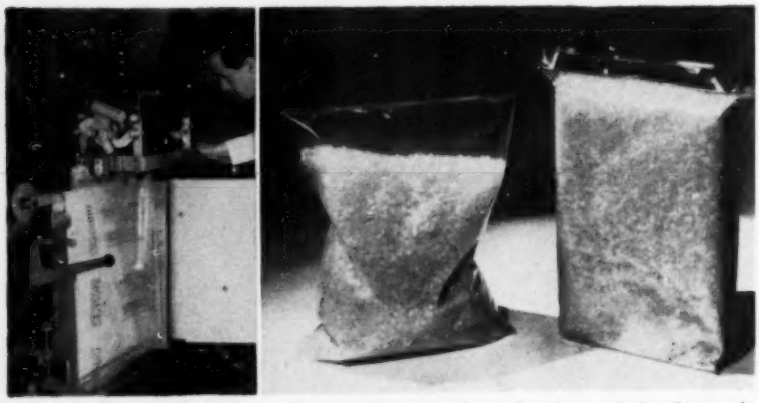
Sack Filling Technique

METAL BOX DEVELOP NEW PROCESS

A METHOD of filling sacks has been developed by the Plastics Group of the Metal Box Co. Ltd. for use with their polythene Diosacks. This process, known as vacuum frame filling, results in a completely rigid pack of rectangular shape. These packs stack closely together, need less space and, being rigid, are very much easier to handle than either paper or conventionally filled plastic sacks. The cost is slightly higher than paper or jute sacks but this is, in many fields, outweighed by the advantages conferred by the physical and chemical properties of polythene.



Diosack held in position under the hopper before the door of the frame is closed. On the right are shown two sacks, one filled and sealed by conventional methods, the other using the new Metal Box Co. vacuum frame filling technique

It is expected that the field in which vacuum frame filled Diosacks will first find a wide application will be in the packaging of plastic moulding materials. The estimated annual usage of paper and polythene sacks for this application in the UK is 20m.

Seeds and Milk

Other important products such as fertilizers and seeds represent a possible market for almost 100m. sacks a year and when certain difficulties in the use of this method for packing powdered materials have been overcome there will be a potential market for a wide range of products ranging from powdered milk to cement.

The future potential for this method may be gauged from the annual output of paper and jute sacks which is over 750m. at present and is steadily increasing.

In the past the industrial sack made from polythene has had several disadvantages. It has been too expensive and difficult to handle and the new method has been developed with these problems in mind.

Metal Box's plant at Portsmouth has been specially designed for the high speed production of tubular film which is also printed and made into sacks during the process. This increase in production rate has brought the price of the sack down to only slightly above that of jute or multiwall paper sacks and future commercial exploitation of the process is expected to lower this still further, while improvements in the properties of polythene would allow the use of a thinner film, also reducing the price.

The handling disadvantages of conventionally filled polythene sacks have been associated mainly with the entrapped air, producing a bulging shape which would not stack properly, and the general floppiness of the package.

The Metal Box vacuum frame filling equipment consists essentially of a mould or frame to give shape to the sack, a vacuum pump to remove the air, and heat sealing jaws to close the sack. The empty sack is placed in the frame under the hopper of material. Compressed air is blown into it so that it takes the shape of the frame and a weighed quantity of material is dispensed from the hopper. The filled bag and frame are removed to the vacuum and sealing stage where a vacuum probe is inserted and 8 to 10in. of vacuum drawn. The seal is then effected, the probe being automatically removed by the closing action of the sealing jaws.

Semi-Automatic Unit

The speed of filling is six 50lb. bags in 5min. using two units in tandem, but work is progressing on a high-speed semi-automatic unit capable of more than five times this speed. Due to the inherent permeability of polythene film, a sack packed at 8-10in. vacuum will, after three or four months' storage, have a vacuum remaining of about 1in., which is sufficient for normal handling. Resistance to puncturing is obviously of importance and reasonable care should be exercised during handling, transport and storage to avoid contact of the sacks with sharp points. Once the sacks are stacked, however, they are kept in their flat shape by contact with the others and will not slip even if puncture does occur.

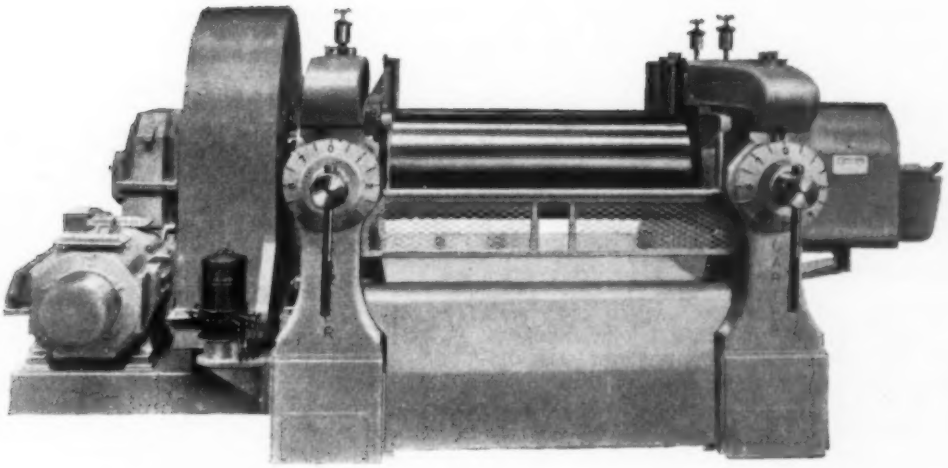
Tests carried out on vacuum filled sacks, unvacuumed polythene and paper sacks show that the vacuum-filled sacks withstand drop tests both of faces and corners, better than either of the other two types. A ball impact test in which a 2in. diameter ball-bearing weighing over 1lb. is dropped onto the sacks from varying heights until spillage occurs, produces spillage from a paper sack at 20-22ft. while the vacuum pack withstands drops from 26ft. or higher, and the unvacuumed polythene from only 20ft.

Unilever-Emery Appoints UK Agent

Price's (Bromborough) Ltd. has been appointed agent and distributor in the UK for the Dutch firm Unilever-Emery N.V., which was founded in 1959 as a joint venture by Unilever N.V., Rotterdam, and Emery Industries Inc. of Cincinnati.

The first products now being produced by the Dutch firm are dimer acids, which will be marketed by Price's under Emery's 'Empol' trade mark. These dimer acids are used in the production of polyamides and rigid and flexible polyurethane foams.

Also to be marketed are the products of the Emery ozonization plant: Azelaic Acid used for making polyamides, alkyd resins and polyurethanes, and also in the production of di-alkyl azelates and polyesters as low temperature PVC plasticizers, and Pelargonic Acid principally used in the production of alkyd resins and esters for plasticizers and PVC stabilizers.



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VIEWS and REVIEWS

WE have learned much about Russian rubber technology from *Soviet Rubber Technology*, that excellent translation by the Rubber and Plastics Research Association of *Kauchuk i Rezina*, produced in collaboration with Maclaren and Sons Ltd., publishers of *RJIP*. This week I propose to review a broad cross-section of papers from two issues.

'Soviet Rubber Technology'

Apart from the political content, which is an odd feature to readers of Western technical journalism, two things strike one: the often naive attitude of great discovery towards phenomena that have been well known for a long time in the West, and the wholly-desirable, brief, clear writing.

Some of the papers traverse ground which is quite familiar to Western rubber technologists, and the conclusions drawn are sometimes so well known as to cause surprise that the work should have been repeated in Russia. It is not true of all the work reported, some of which is highly original, but some of the reports almost give the impression that natural phenomena in Russia are thought to be different from those in other countries.

Does it arise from a shielding of Russian technologists from foreign technical information? How else can one explain, for instance, the ponderous ignorance and unsophisticated pretentiousness of the paper 'Formulation of Self-vulcanizing Materials for Repairing Pneumatic Tyres,' by Koshelev, Fedyukina, Melamed, Kamenski, and Vostro'tnutov (five authors for quite a short report on a simple investigation!).

It begins: 'The repair of pneumatic tyres, particularly inner tubes, by vulcanization without heat, has been known for a relatively long time. Until recently, however, this method has not been widely used. Self-vulcanizing materials were used for repairing inner tubes and small tyre defects in Germany during the war. In recent years such materials have become widely used in West European countries, especially Western Germany, Italy and Great Britain, and from 1954 in America also.'

Self-vulcanizing Adhesives

The paper goes on to say, with references to the literature, that self-vulcanizing retread compounds are now 'used abroad for practically all types of tyre repairs' and that 'according to American data, the method is 1.5 times more economical than the normal retreading by hot vulcanization.'

The article then deals with the composition of Russian self-vulcanizing doughs and solutions, based on natural rubber, in two-component form. The one part consists of smoked sheet, sulphur, epoxy and phenol-formaldehyde resins, and an antioxidant, and the other part consists of smoked sheet, ultra accelerator (zinc dialkyldithiocarbamate), curing agent (a polyamine), active filler (such as colloidal silica, gas black, silicates), phenol-formaldehyde, and an antioxidant.

It was found that the partial replacement of the epoxy by a phenol-formaldehyde resin increased the storage stability.

Ply-separation tests were made on mixes with different fillers at a range of times, and also on samples at 100°C. to determine temperature stability.

There is very little else in the report and its final conclusion is: 'The solutions, doughs and rubber stocks can be recommended for repairing inner tubes, tyres (tubed and tubeless), belts, hose, rubber footwear, and for coating chemical apparatus, leather and many other articles with rubber.'

Rubber and Friction

A paper in the May issue (pp. 30-32) is, I think, entitled to more consideration and respect. Entitled 'Friction between Rubber and Hard Substances,' it is the work of only one author, M. M. Reznikovskii, and 'attempts to make a purely mechanical examination of the phenomenon defined as the friction of a soft, incompletely elastic material (in this case rubber) on a hard, rough surface.'

This is a somewhat different approach from the common one based on an analogy between the external friction of a rubber and the internal friction of liquids (*i.e.* viscosity) because of their common dependence on temperature and rate of shear.

It is of fundamental importance to realize that the local deformation of rubber is not a completely elastic phenomenon. A simple model, based on tangential displacement without surface friction, enables the elementary act of slip to be examined on the basis of rolling tests. We begin with Kelvin's well-known visco-elastic equation:

$$p = kw + x(dw/dt)$$

Where p = pressure, w = displacement or deflection, k = stiffness and x = coefficient of internal viscosity.

The law of friction can be derived as:

$$F = (xc/kr)\,N$$

F and N are, respectively, the shearing force and normal load, and c is the rate of tangential displacement.

The main conclusions from this do not contradict any known facts, although they eliminate the qualitative difference between sliding and rolling friction. It follows that the frictional force must be inversely proportional to the average radius of curvature of the irregularities on the contact surface.

Inadequacy of Primary Equation

There are deviations — which the author attributes to the inadequacy of the primary, Kelvin, equation — but the main premises are confirmed by experimental data on speed and time dependencies of the shearing forces with sliding and rolling friction.

A table of summarized test results shows that the coefficient of friction on steel depends on the composition of the rubber, that the coefficient and the ratio of internal friction to elastic modulus tends to decrease as vulcanization increases, and also to increase with increasing content of reinforcer.

The paper concludes wisely by pointing out that this is not the whole story, several other factors being concerned, but 'the basic facts in the friction of rubber over a hard, rough surface, may be qualitatively explained by

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **F. C. JENNINGS**

a purely mechanical examination of incompletely elastic deformations in sliding contact.'

Carbon Black in Butyl

Pages 49 and 50 of the May 1960 issue of *Soviet Rubber Technology* present a method for 'Determining the Carbon Black Content of Butyl Rubber Vulcanizates.' Decomposition with nitric acid being unsuitable, the suggested method is based on boiling the sample in kerosene for 3-4 hours (a final separation using nitric acid may be necessary sometimes). Centrifuging assists filtration.

After acetone extraction, boiling with kerosene and filtering, the residue in a Gooch crucible is washed with chloroform and with a mixture of equal volumes of acetone and acetic acid, and then alternately with acetone and 20% HCl. It is then dried, weighed, ashed, and re-weighed. After the obvious calculation, a correction factor of 1.05, which has been determined empirically, is applied.

Improving Tyre Production

The May issue also carries an account of a conference held in Moscow to discuss ways and means of improving tyre building and production processes. It starts with the statement: 'It is known from experience that the average mileage of tyres assembled under supervision is 10% higher, and the number of failures for production reasons 30% lower, than for normal production tyres.'

I would have thought these figures to be much higher than in the West, and would be pleased to hear from readers on this point, but not much information is given in the article as to how to remedy the trouble. Comparisons were made between different processes. 'To manufacture 100 750-20 tyres by the layer assembly method at the Yaroslav works took 70.8 man-hours in 1959, and 73.6 man-hours by the bond assembly method; at the Moscow works the figures were 50.7 and 64.5 man-hours respectively, and at the Voronezh works—69.2 man-hours by the combined method.'

About 90% of the cost of a tyre is for materials. The greatest reduction in cost, therefore, is to be made not in labour but in materials. One fruitful method of analysing material costs, and of indicating possible sources of material savings, is by making comparisons between the same sizes of tyres produced at different factories.

Their political organization is such that the Russians can make comparisons of this kind more readily than they can be made in the West. An article in the June 1960 issue of *Soviet Rubber Technology*, pp. 39-40, is based on this approach. Called 'Regulating the Consumption of Material in Tyre Manufacture,' and written by Gurevich and Strongin, it presents comparisons in the usages of rubber and cord in the manufacture of three sizes of tyres at five Russian factories.

The comparisons show up surprising differences in manufacturing specifications between the different factories. For example, one of the factories uses only one breaker strip in its 7.50-20 tyres, while all the others use two. It is not surprising, therefore, that one of the recommendations is that existing specifications should be revised by the Scientific Research Institute of the Tyre Industry together with the works.

Another paper with a similar end in view is 'Device for the Continuous Recording of the Width of Tyre Components' by Michelevich and Gurvich of the Leningrad Tyre Works (pp. 47-8 of the June 1960 issue). The device is very simple. For measuring continuously the width of a moving band of tyre cord, the movements of two rollers in contact with the edges of the cord are mechanically transmitted to an electrically-operated recorder.

'The device can also be arranged so as to give a visible or audible signal when the width of the material varies below or above the permitted level.' Work is proceeding on using the device as a basis for an instrument for automatically adjusting the width to a set figure.

Brevity in Writing

I am sure that most British and American rubber technologists will agree with me that there is nothing really startling in these papers. But there is a feature which we, in the West, could well afford to copy — the deliberate brevity and conciseness with which they are written. I have no doubt that some praise for the clarity of these papers must go to the translators — by its nature, good translation must clarify — but the brevity must be a virtue residing in the originals. It was last September that I here wrote of the concern of G. A. Shires — who, as manager of the Dunlop Research Centre's Information Department, has to deal with hundreds of technical papers a year — that the average technical paper is too long. These Russian papers do what Mr Shires wants: look for the short way of saying things and, above all, omit the unnecessary and even the less important.

Perhaps I have also done less than justice to the subject matter of the papers in these two journals. Among those I have not commented upon are papers dealing with thermal ageing in the absence of oxygen, vulcanizing with MBTS, shock absorber cord, designing moulds for rubber footwear, equipment for varnishing boots, cold resistance of rubber, measuring the diameter of rubber thread, graft copolymers of styrene and rubber, accelerators for the vulcanizing of chloroprene, mechanism of reclaiming, and factors affecting the strength of a cut joint.

IRI Getting Together

The secretary of the Institution of the Rubber Industry, G. E. Holmes-Siedle, has kindly answered some of the questions I raised in my recent comments. He points out that the motto, 'To promote a better understanding and a closer relationship between all sides of the rubber industry,' does in fact appear in each issue of the Transactions and sends me a copy to prove it. There it is, as I have so often seen it but not noticed it, with a page to itself and illustrated for some reason not very obvious with a picture of a book, a candle, and a pair of spectacles.

Mr Holmes-Siedle does more, he tells me what it means — which, he says, is what it says — 'it brings together those engaged in rubber and allied manufacture (all grades), natural rubber production, synthetic rubber production, teaching, research.'

The secretary of the Plastics Institute has also been attracted by what I wrote about the IRI and has been kind enough to provide me with information about the PI which I hope to use soon.

CHARLES JENNINGS

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MEN *and* MATTERS

A Review of People and Events

by Peter Richards

THE skeleton in a medical student's cupboard is now, more often than not, made of plastics. I am told that one of the first plastic skeletons in the world was made in a basement in London Road, Croydon, 11 years ago. This was the starting point for Educational and Scientific Plastics, Ltd., which was founded by the late T. W. Fazakerley, and has since developed into what must be one of the most unusual businesses in Britain. In 11 years the firm has developed a series of models for educational and medical purposes and has built up a flourishing export trade in plastic brain and hearts with more than 40 countries. 50% of the company's products are exported.

In 1951 the firm introduced 'a bouncing brain' — a flexible rubber model showing accurately and graphically in accepted distinguishing colours the various areas of the human brain. Hearts, ears, kidneys, lungs and other parts of the anatomy followed in rapid succession, culminating in the Skeletorso. This *tour de force* is a model into which the entire internal anatomy of the body is built and can be removed, organ by organ, from a skeletal structure.

Brain Factory

This month Educational and Scientific Plastics has moved into a new factory and offices on the Holmethorpe Industrial Estate at Redhill. It is said to be the first factory in the world built solely for the design, development and manufacture of models of skeletons, hearts and brains.

Most of the sales are, of course, to schools, universities and teaching hospitals. But I wonder if there is also a consumer market in skeletons? The other day I saw in an optician's window an anatomical model, about a foot high. 'The Visible Woman,' said a notice, 'Buy One Today.' It looks as though someone has done motivational research into the buying habits of hypochondriacs.

Polythene Splints

Another medical development connected with plastics is the use of porous polythene for making some types of orthopaedic splints and appliances.

Vyon — made by the Dagenham firm Porous Plastics Ltd. — is hand moulded on positive plaster casts to form the splints. These are very light — for example, a cervical collar (which fits round chest and throat) weighs only 12oz. — and, since the material is porous, sweat can evaporate easily.

Spring Motoring

The recent mild weather must have made many keen motorists take maps from their car lockers and begin to plan their holidays. If their maps are anything like mine — out-of-date, dog-eared, marked and creased — they will not have progressed very far.

Dunlop's publication of a new and improved Touring Atlas is therefore a welcome one. It is right up-to-date, showing the new and projected motorways. There is a useful through route map, a complete index, and altogether it is very good value for 7s. 6d.

Stretching a Point

Normally it would be out of place here to refer to an advertisement which has appeared in *RJIP*. This week, however, I feel justified in stretching a point in order to congratulate the International Synthetic Rubber Co. One of this company's advertisements, which appeared in *RJIP* last year, was runner-up for the 1961 Layton Trophy — the supreme award of the advertising world. The advertisement — 'Stretch' of the 'Stretch,' 'Squeeze,' 'Give' and 'Bounce' series — also took first place in the industrial section.

A dinner in London was given by North British Rubber Co. in honour of Leighton Smith, when he retired recently after 38 years with the company. He was sales manager of the general products division, and is remaining with the firm in an advisory capacity. Here, R. D. Hunt, deputy managing director (left) makes a presentation to Leighton Smith

Fishing for Mermaids

A mermaid would come under the category of 'a good catch' and it would be safe to assume that she would be much more friendly towards the lucky fisherman if caught in a Rigidex high density polythene net, rather than being smothered in tar and slime from a dirty old rope one.

British Resin Products Ltd. showed their new film 'A Good Catch' about fishing nets and lines last week and, although they had not actually been able to film the capture of anything so exotic as a mermaid, there were some very good shots of Norwegian fishermen at work. The film described the manufacture of high density polythene at the Grangemouth plant of British Hydrocarbon Chemicals and showed the subsequent production of monofilament, twine and fishing nets in some detail.

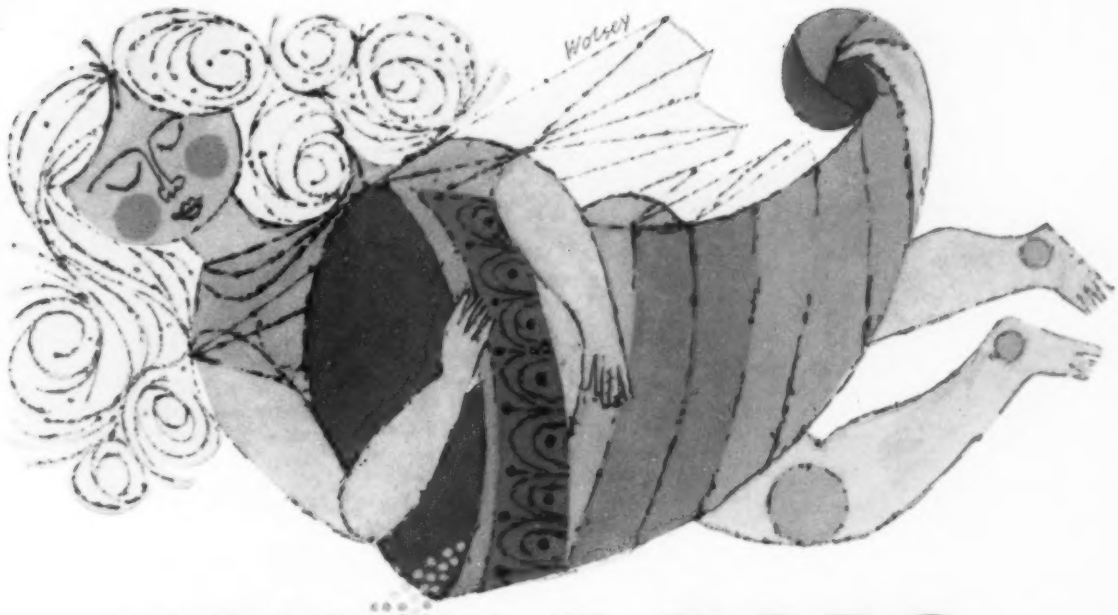
Polythene has many obvious advantages over conventional materials for this application and the film was a very good illustration of yet another way in which the frontiers of plastics are being extended.

Dow International

Election of Zoltan Merzei as a vice-president and general manager, European operations, has been announced by C. B. Branch, president of Dow Chemical International Ltd. S.A. In his newly-created postion Mr Merzei will be responsible for all operations and functions for Dow subsidiary and affiliated companies in Europe. He will continue to make his headquarters in Zurich, Switzerland.

Preserving the Boat

The new and the old came together recently in the preservation of an ancient boat discovered at Kentmere in Westmorland. The boat, which was discovered on land worked by the Cape Asbestos Co. Ltd., was subjected to radioactivity tests by Dr A. E.



NONOX B RODS

The outstanding rubber antioxidant NONOX B is now available in the form of rods, making it easier to use yet maintaining its full antioxidant efficiency.

* NON-DUSTING * NON-FLYING
* FREE FLOWING * EASY TO WEIGH AND HANDLE

NONOX B RODS can be dispersed quickly and conveniently on a warm open mill or in an internal mixer.

Full information on request.

IMPERIAL CHEMICAL INDUSTRIES LIMITED LONDON SW1 ENGLAND

P2

Werner of the British Museum. These tests established that it was made round about A.D.1320.

The wood was completely waterlogged when found, and had to be allowed to dry out very slowly by covering with bracken and earth and leaving for nearly two years. The pieces were then very fragile, and were consolidated by applying a special cold-setting 'Araldite' epoxy resin mulation. This restoration work was carried out at the National Maritime Museum, Greenwich.

Mulching Potatoes

'Why dig potatoes — when they can be picked like fruit?' So runs the heading of a Commercial Plastics leaflet on Fablothene black polythene mulch film.

The leaflet is part of a campaign by Commercial Plastics to persuade the amateur gardener to grow potatoes under film. The potatoes grow on top of the soil; an early crop can be produced, and it is possible to prolong the harvest by picking the largest potatoes first and replacing the mulch to allow the smaller ones to grow.

Work carried out at the National Institute of Agricultural Engineering has shown that mulching potatoes in this way has produced 9.1 tons per acre against 5.3 tons for conventional soil covered rows, and in the USA a yield increase of as much as 160% has been reported.

Warerite in Dublin

A 'Warerite Cup' will be presented in Dublin for the first time today (February 25), for the best furniture design incorporating Warerite laminated plastics.

Judging the displays will be a panel of women feature-writers from the *Dublin Evening Press* and the *Dublin Evening Mail* and, in addition to the cup, prizes of £25, £10 and £5 will be awarded together with certificates of merit.

Appointments in Brief

Dr W. D. Scott, managing director of BTR Industries, has been elected chairman of the BTR subsidiary, Artrite Resins, and Dr G. Ader appointed as its managing director.

* * *

Mr R. A. J. Moseley and Mr J. H. G. Wyld have been appointed directors of David Moseley and Sons. Mr C. A. G. Burney has been appointed a director of Capon Heaton, the wholly owned subsidiary company.

* * *

J. W. Haig-Ferguson has been appointed managing director of R. and J. Beck, Ltd., which is a member of the Griffin and George Group.

THE LEGAL ANGLE

Reasonable Notice

By a Barrister

'I have enough problems as a manufacturer of rubber products, without asking for trouble. And when I dismiss staff, I don't want them to come bouncing back at me, with writs in their hands, suing me for damages for wrongful dismissal.'

Very sensible. And there is a simple solution — do not dismiss wrongfully. If there are not sufficiently serious grounds to warrant the summary sack, give proper notice or wages in lieu.

'Which begs two questions — what must an employee have done to warrant summary dismissal . . . and what notice or wages in lieu is "proper?"'

Contract of Service

You can dismiss summarily—subject to Union agreements — if the servant has done something so contrary to the letter or the spirit of his contract of service as to show that he no longer intends to be bound by it: stealing, for example, or revealing secrets to competitors; refusal to obey a really serious and lawful order; persistent negligence, rudeness, insubordination or lateness. But not, you will note, the odd late occasion, the minor act of negligence, the comparatively insignificant order ignored.

'That seems quite reasonable. But what about notice. . . ?'

You must give the servant such notice as was provided for in the contract of service. In other words, if you agreed between you that a specified period of notice would be given on either side, to determine the arrangement, then that is the end of it. And this applies whether the contract was oral or in writing.

'And if there was no such term agreed?'

Then the Court will imply one. It will take for granted that you must have intended that 'reasonable notice' would be given.

'And what notice is "reasonable?"'

A Question of Fact

That is a question of fact, differing in every case. But the sort of matters which the Court will take into consideration are the degree of the servant's responsibility, how long he has been with you and how much he is paid and how often. Thus, your secretary might get two weeks, your cleaners only one, your foreman four weeks and your directors six months — but these are only guesses and guides. If you want more precise information, you must consult your lawyer, giving him full details of all the facts. And then he will make a pretty shrewd guess as to the answer.

'And if you would rather not have the person around, but have no excuse for throwing him out. . . ?'

No Danger of Legal Action

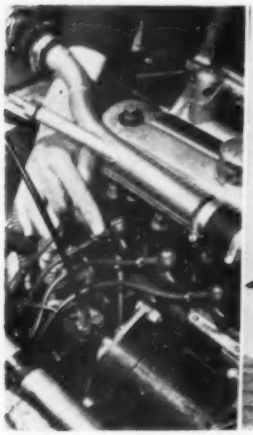
Then you give him the amount of wages which he would have earned during that period of notice, and you will run no danger of a legal action.

'Can you always dismiss an employee by giving reasonable notice or wages in lieu?'

That — or the notice or wages agreed in the contract, if any. With one exception — if the employment offered was 'permanent' you may find yourself stuck with an employee whom you do not want at all. But then you should not have made a lifetime marriage with a person whom you do not wish to love, honour or obey, in business hours, anyway.

Polly Ester Says . . .

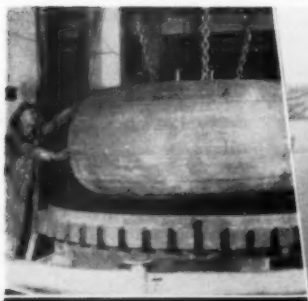
'Mean carcass line — stingy butcher's sales talk'

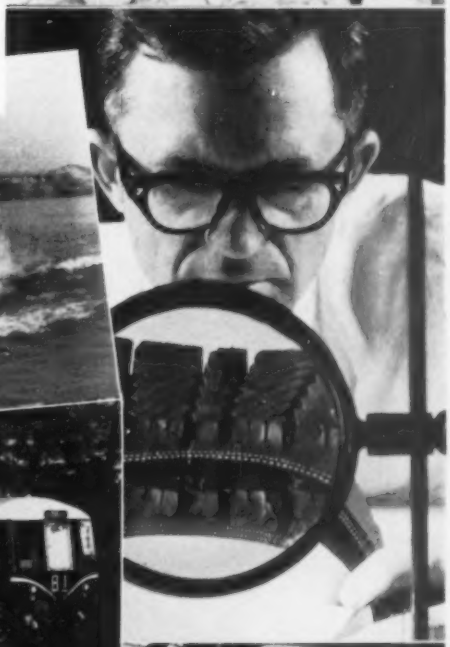


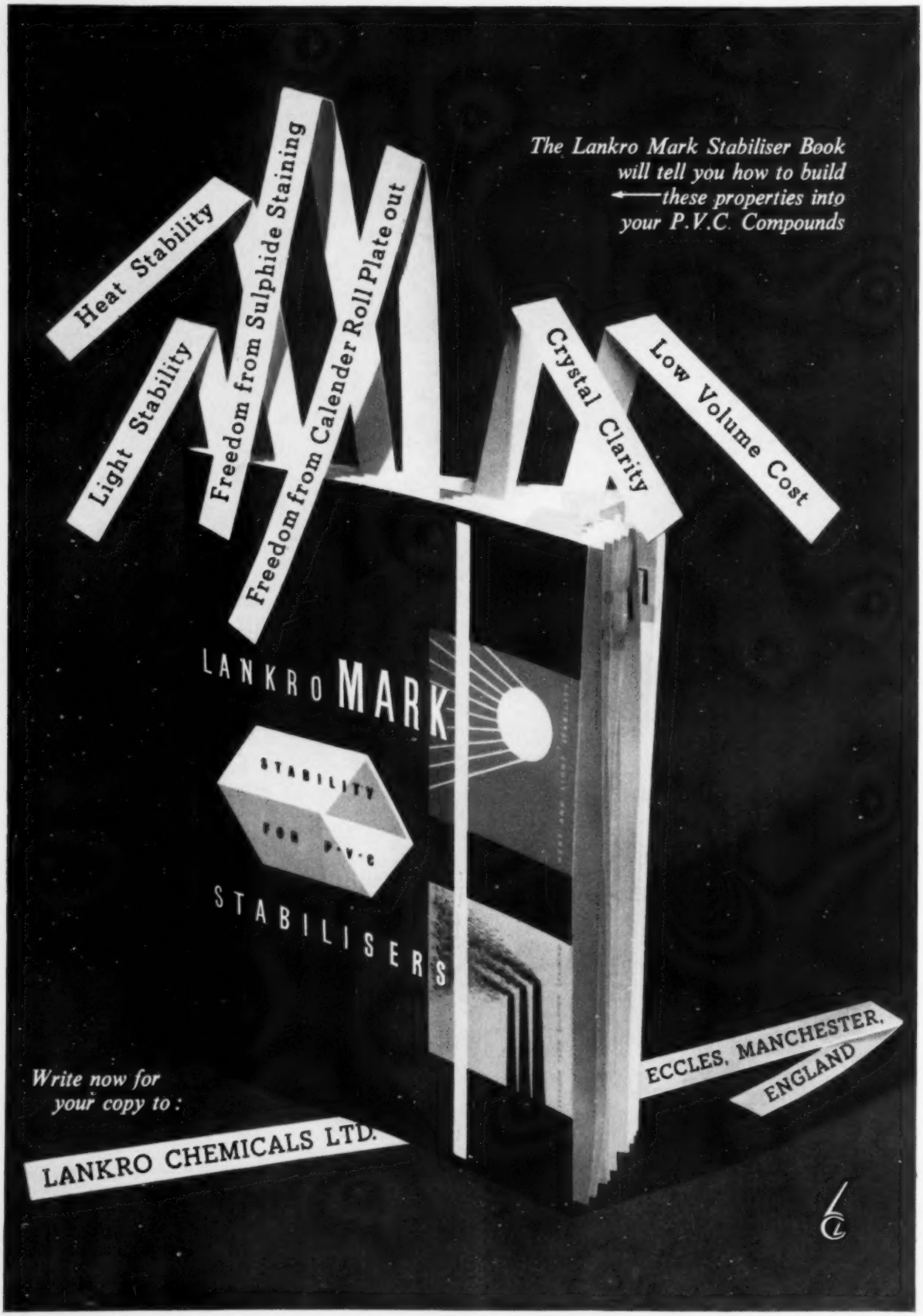
AN RJIP SPECIAL FEATURE

Rubber and Plastics in Transport

A key to the applications on this page appears on page 296






The Lankro Mark Stabiliser Book will tell you how to build these properties into your P.V.C. Compounds
Heat Stability
Light Stability
Freedom from Sulphide Staining
Freedom from Calender Roll Plate out
Crystal Clarity
Low Volume Cost
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Rubber and Plastics in Transport

Effects of the Recession

10lb. of plastic and, in addition to tyres, more than 200 rubber components are estimated to go into every small car. This article analyses the effect of the current recession in the car industry on the manufacturers of these rubber and plastics components

By our Financial Correspondent

FIVE . . . four . . . three . . . two-and-a-half. . . . This is not a count down for a Polaris missile or any other kind of rocket. It records, in fact, the sorry times that have overtaken the working week of the car industry over recent months. From 'boom' the trading barometers of most of the companies have swung sharply in the opposite direction. Now they read 'gloom.'

All the giant manufacturers of the popular models have been seriously affected. Their sales both at home and overseas have taken some sharp knocks. Makers like Ford, British Motor Corporation, Rootes and Vauxhall have all reported their fair share of the bad conditions, while the go-ahead Standard Triumph International group has had to disclose that heavy losses have been sustained — one of the main reason for the 'marriage' proposals with lorry makers Leyland. It is necessary to take a closer look at this situation before I consider the effect on manufacturers of rubber and plastics components.

Outlook Uncertain

The outlook, though a little better than it was at the heart of the crisis period, is still obscured with many 'ifs' and 'buts.' It is true that the production schedules of some manufacturers have improved recently, but I feel, even so, that the manufacturers are not clear of the wood yet. Even the companies mentioned have not yet been able to reach all round agreement as to when the decline will be eventually stemmed. Some think at the moment that the pick-up already referred to will continue into the spring. Others have re-cast their earlier forecasts to the autumn and even next year.

Some idea of how they have been suffering was provided by George Harriman, the managing director of the mighty BMC, Austin and Morris 'empire' — our biggest car firm. The other week he said that current production was running at a rate of 9,000 vehicles a week. This compared with a figure of 15,000 a week when the group's various works were going flat out. It shows that BMC is, in actual fact, working at only 60% of capacity. Using this as a rough yardstick because, after all, it is a leader in its field, one can appreciate the problems that have yet to be surmounted before the smiles return to this hard-working industry.

Drop in Component Consumption

The motor makers, on the whole, are pretty well self-sufficient, as a trip round the Ford works at any time will show. But despite this they do depend on many other manufacturers for accessories. Ten pounds weight of plastics, for instance, goes into every model. Rubber components, in addition to tyres, are estimated to make up 200 individual parts in a small car. Let us stop for a moment and think about those BMC production figures. You can see that when the company was working with all stops out it was a buyer of something like 75,000 to 100,000 tyres a week. Now, at a shrewd guess, I would put the figure at around 45,000. Plastic tonnage sales likewise must have taken quite a beating, too.

So you would think that the ripples of the car industry's troubles were also causing some headaches among components manufacturers. This, in part, is, of course, true, though upon investigation among the big tyre manufacturers, for instance, I found no undue pessimism. Naturally, in this highly competitive supply field, no one is prepared to give much away for fear that the other man might come to the wrong conclusion. Talk about tyre price charges and what percentage of the market they supply and you only meet with polite rebuttals or the more fashionable 'no comment.'

However, there were a few general questions I was able to put from which I obtained a definite answer. I asked, for example, Goodyear Tyre and Rubber whether or not the motor setback had resulted in any short-time working. Back came the news that less than 5% of the company's workers had been affected and that was only to the extent of one shift a week. Nothing here, I venture to suggest, to get too worried about. I also wondered whether the group's plans for expansion had been upset at all. 'No,' was the prompt and cheerful reply, 'they have not been affected in the least.'

Avon India Rubber had this to say in their full report to shareholders.

'The reduced activity in the motor car industry is having adverse effects on tyre sales, but your directors believe that in the long term the expansion of the rubber industry will continue and they have confidence in the future demand for the high quality products of the group.'

Rich Fulfilment

Again the degree of optimism that underlines this statement leaves one with the strong impression that though these firms recognize that all is not well at present, the hopes that ushered in the 'sixties' last year continue to run high for a rich fulfilment in the near future.

In fact, the more one explored into this survey, the better the long term outlook appeared.

Still on the expansion theme it is worth mentioning the plans of Ferodo, clutch and brake lining specialists, which is an offshoot of the Turner and Newall asbestos group. It reported that a £2.5m. project has been launched at Griffiths Crossing near Caernarvon. It is also expected that a further £1m. will be spent on additional plant and equipment at the Ferodo factory at Chapel-en-le-Frith up in Cheshire.

Like myself, Sir Bertram Waring, head of the Joseph Lucas organization, is not over worried at the moment about the outlook either.

In his annual round-up of the com-

pany's affairs that made its appearance only a short while ago, he said this:

'The most promising factor for the future is the declared intention of British vehicle manufacturers to expand their manufacturing facilities at a cost of approximately £250m.' And he pointed out that the current temporary recession has in no way altered these intentions. 'Looking either backwards or forwards there is no reason why it should,' he added.

This, I feel, sums up the whole crux of the current situation and provides yet another important key to just how other leaders in this particular field are thinking at the moment.

Sir Bertram's expansion plans are going ahead like the rest we have discussed. The group, he says, is in the course of setting up new factories in the Liverpool area and at Burnley. In these two districts Lucas already employs 7,000 people. Plans for manufacturing units in other areas are also under consideration.

Early for Spring

From the £180m. Dunlop Rubber Co. came news this month that the group has made an encouraging start to its current trading year. But, said managing director Reay Geddes in an interview, 'it is still a little early to say that spring is really bursting out all over in the motor industry.'

It is estimated that around 70% of Dunlop sales are in tyres, the company supplying nearly half of the British market. It seems, however, that the dip in car sales has had only a small effect on the company's trading activity.

Said Mr Geddes: 'Of the 40,000 on our pay roll, only about 7½% are on short time.' He gave three factors for this remarkable show of resilience. First of these was that the group carries on a considerable export business, which, of course, has proved a useful cushion against the reduced demand from car makers at home. A second reason he put forward was replacement tyre sales. Apparently they fluctuate more with general business conditions and new car deliveries two years previously than with the current ups and downs in the motor industry. The third factor has been diversification into other products than tyres. Mr Geddes said that he thought that Dunlop's share of the home market was certainly increasing a little.

No Short Time

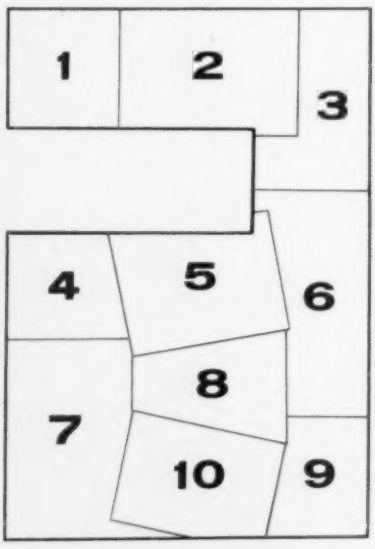
During my round of calls I looked in on Ekco Plastics, who told me that they had experienced no short time working, as yet. Their interests were diversified enough to offset any ill effects that might have been felt from the recession. And their position had further improved since the merger with Pye. 'We are not unduly worried,' they told me, and 'We consider the outlook pretty good.'

The same kind of opinion was put forward by the spokesman for British Insulated Callender's Cables, who quite rightly thought that 'the car trade is the sensitive nerve in any economy.' He admitted that the situation in the supply of components such as winding wires 'has been a bit spotty.' Here, again, none of the company's workers have had their working week cut. In this man's view the car situation has touched the bottom and 'we are coming out on the other side.'

Confidence in the Future

All in all, then, although some companies at the moment are feeling the pinch, their confidence in the future, as yet, shows no sign of slackening. Of course, manufacturers back their opinions by pointing out that the statisticians have forecast that in 1970 world output of all types of motor vehicles will reach 19m. per annum, compared with 14m. in 1959.

I agree with those who think that the home market will expand substantially. The average disposal net income per head of total population will rise between 20% and 25%, during the next ten years. The small increase in real earnings has also brought a large increase in the number of car owners, and this process will undoubtedly continue — with a consequent increase in the sales of manufacturers of rubber and plastics components.



UK Rubber Interleaving for US Ford

The Dunlop Rubber Co. Ltd. is beginning the manufacture of rubber interleaving for springs which are being supplied to the American Ford Company of Detroit by Toledo Woodhead Springs Ltd. of Ayecliffe, near Darlington, who have for many years been suppliers to Ford of Dagenham.

Initial production will be at the rate of 800 units a day. The rubber interleaving eliminates lubrication and increases spring life.

These interleaves are being made by Dunlop to extremely close tolerances, from a compound of butyl rubber which is said to have excellent damping properties and high weathering resistance.

The experimental production was carried out by the development division at the Dunlop Research Centre, Birmingham, but the main production will be at the Manchester factory of the general rubber goods division.

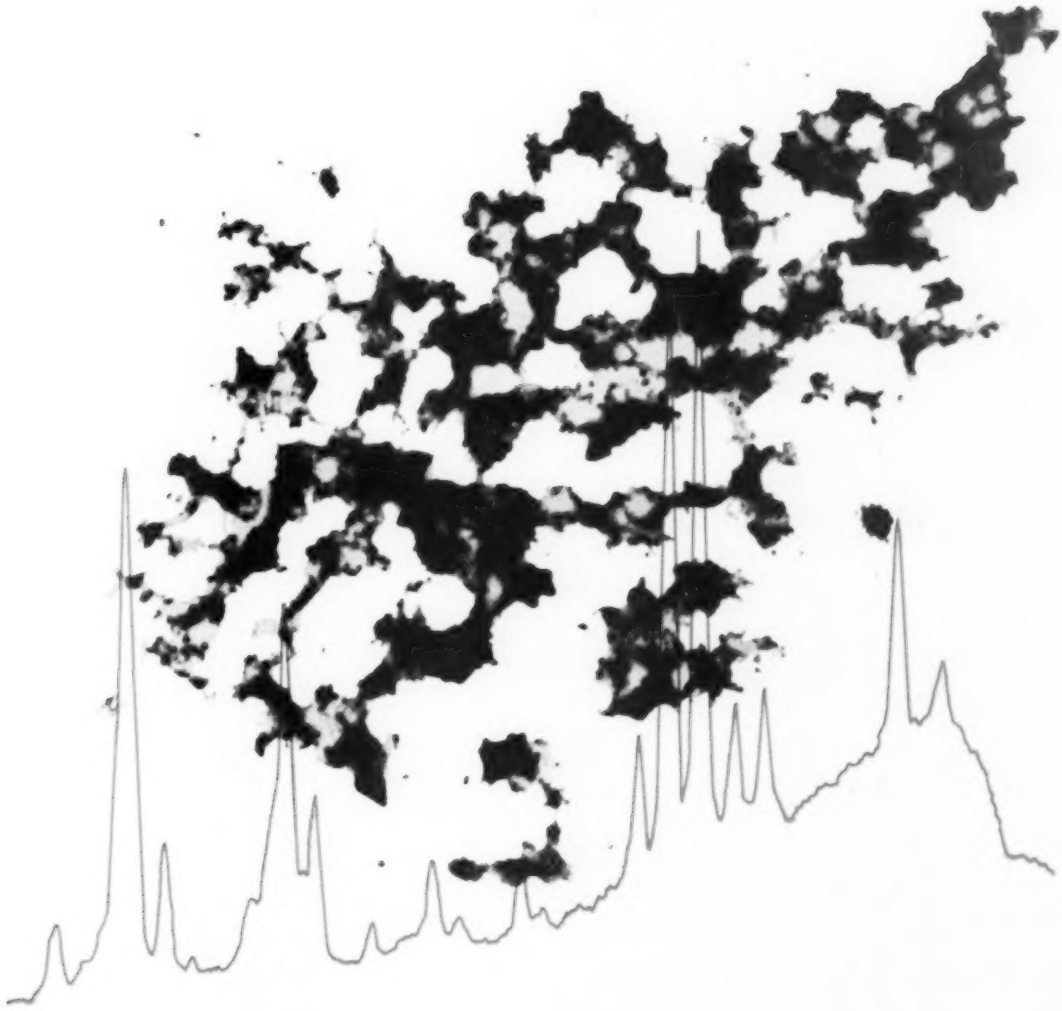
Two-ply Tyres

The United States Rubber Co. has sold more than 350,000 two-ply passenger tyres on the domestic replacement market since it began production in the second quarter of 1958.

G. Raymond Cuthbertson, vice-president and general manager of the tyre division, said the tyres, made principally for smaller cars, are giving 'excellent service.'

Key to Transport Applications on page 293

1. Neoprene plug covers and cable sheathing. 2. The English Electric Lightning has many rubber and plastic components including the GRP rocket packs. 3. The Pirelli BS3 tyre with removable treads. 4. The largest aircraft tyre ever produced by the Goodyear Tire and Rubber Co. 5. The Palmcraft 20-ft. cabin cruiser built from glass reinforced Bakelite polyester resin. 6. B. F. Goodrich Co's new two-ply tyre compared with a four-ply tyre. 7. The Dunlop high speed tyre-testing equipment. 8. The canopy of this BR diesel is made from Scott Bader's Crystic polyester resin. 9. London Transport Routemaster bus. This is fitted with air-suspension equipment either of Dunlop or Firestone design. 10. The Elva Courier 1½ litre sports car has a contact moulded glass reinforced polyester body



TITANIUM OXIDE LAPORTE

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Rubber and Plastics in Transport

Rubber in Vehicles and Aircraft

TAILORED ELASTOMERS FOR SPECIAL APPLICATIONS

By PHILIP HUTCHINGS,
The Avon India Rubber Co. Ltd.

IN 1959 approximately 55% of the UK consumption of rubber was used in the manufacture of tyres and tyre products. When the rubber needed for the 200 or more rubber components in the modern motor vehicle and the even greater number of rubber parts in the aeroplane is added, it is clear that the vehicle and aircraft markets maintain a dominant position in their demands on the rubber industry.

Rubber in Cars

The use of rubber in vehicles was for some time confined mainly to tyres and this still remains the biggest single application. The proportion of tyres and tyre products to other rubber products can be seen in Table 1. A breakdown of tyre production shows the tremendous rise in the number of car tyres manufactured (Table 2). Recent years have seen the rise of the tubeless tyre and this type has, since 1957, constituted a majority of new car tyre production (Table 3). This has led to a fall in the production of tubes in proportion to covers manufactured. However, the tube itself now has improved air retention due to the utilization of butyl.

From Table 1 it can also be seen that synthetics are being used to an increasing extent in the manufacture of tyres. Besides the numerous technical advantages of synthetics, additional impetus to this development has been given by the fluctuating prices of natural rubber, and the need to fill the gap between production of natural rubber and world rubber requirements.

Since 1958 the International Synthetic Rubber Co.'s plant at Hythe for the production of general purpose rubbers, and the plants set up by Monsanto at Newport for high styrene and acrylonitrile/butadiene polymers, by Dupont at Londonderry for neoprene, and for nitrile rubbers by British Geon at Barry, have given the UK greatly increased synthetic production.

Besides synthetics, the other major advances in tyre rubber have been in the improvement of carbon blacks and antioxidants with a consequent effect on the life of tyres.

In giant tyres the major development has been the braced or rigid tread, utilizing steel in the tyre carcass, and a parallel development in the use of nylon casing. Improvements have also been made in rayons.

Recent work on tyre design and construction has shown a major breakthrough in road holding where a significant improvement has been achieved with new rubber compounds. These new 'cling' rubbers have a high internal hysteresis loss which enhances road holding on dry and wet roads. The drawbacks usually associated with high hysteresis loss rubbers, overheating and increased rolling friction have to a great extent been overcome by a twofold construction adjusting compounds in undertread and sidewall.

A Job in Every Section

The tyre is still the major rubber component in vehicles but since the '20s there has been a steady rise in the amount of rubber used for other car components. In 1925 a car might have contained 2-5lb. of rubber (excluding tyres) mainly applied in anti-vibration mountings, hoses and belts. Today an average car may contain upwards from 60 to 120lb. of rubber parts and rubber has a job to do in almost every section of the vehicle.

A large contribution has been made by rubber to passenger comfort. Upholstery still consists mainly of natural rubber latex foam, giving advantages in ease of fabrication, in vibration and shock damping and in the consistent retention of shape. Foamed synthetics are gaining a foothold in this field and the future may well see their wider adoption. In addition to this, rubber webbing has been used in seating. Other improvements in comfort have come from sealing strips for doors and windows, insulating the interior from rain and dust and cutting down noise, rubber coating for the underside of cars, and insulators and flexible joints in different parts of the vehicle.

Another recent advance in the use of rubber for cars has been in suspension systems. Used in the past for shock absorbers and shackle liners rubber has now become, in certain cars, the main suspension. The evolution of the car has made this increasingly desirable, for greater rigidity in chassis design and the development of unit construction has increased the transmission of noise and vibration and made the insulation of suspension and engine from the rest of the car a prime necessity. The future may see the complete isolation of the engine from the remainder of the car by rubber mountings, for many years the practice in the expensive car, spread to the popular mass production vehicle.

Three of the most important applications of rubber as the springing material in suspension systems have been in the Midland Red buses, the Austin 7 and Mini-Minor, and the Austin Gypsy (Fig. 1). Midland

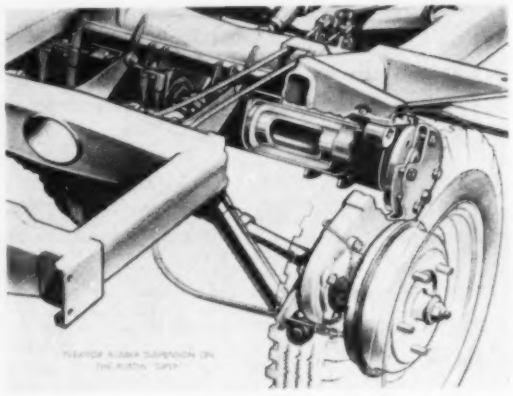

Fig. 1. A cut-away drawing of the Flexitor unit fitted to the Austin Gypsy, the first vehicle in series production to have independent four-wheel rubber suspension

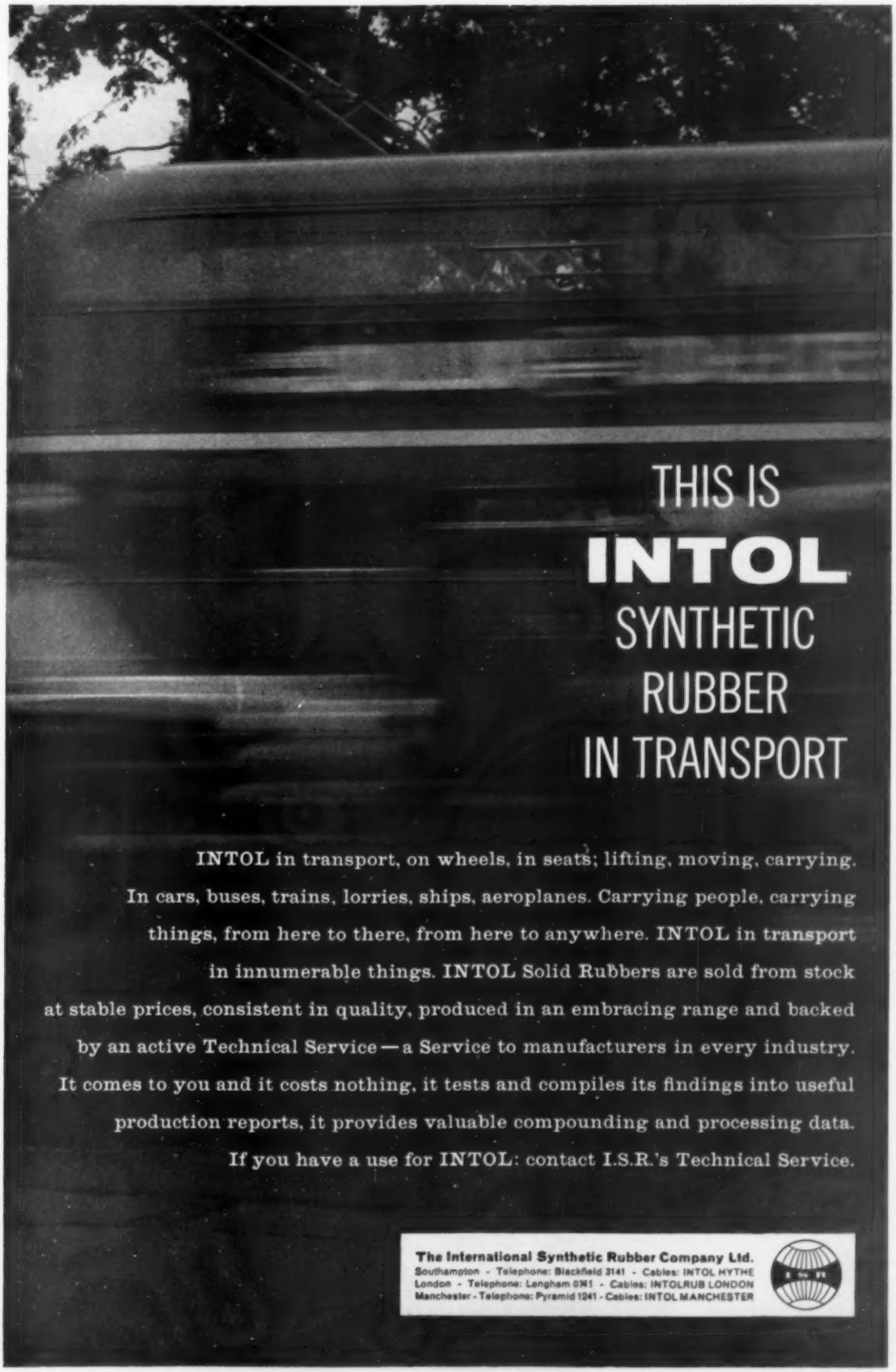

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TABLE 1
UK RUBBER CONSUMPTION BY END PRODUCTS

	Tyres and Tyre Products			All Other			
	Natural	Synthetic	Total	Natural	Synthetic	Total	Grand Total
1949	106,484	69	106,553	77,771	2,319	80,090	186,643
1950	128,634	25	128,659	91,034	2,740	93,774	222,433
1951	135,781	50	135,831	98,453	3,827	102,280	238,111
1952	107,949	125	108,074	89,319	4,786	94,105	202,179
1953	115,490	403	115,893	91,101	4,459	95,560	211,453
1954	130,900	2,697	133,597	108,019	5,996	114,015	247,612
1955	136,813	11,052	147,865	109,537	9,402	118,939	266,804
1956	97,995	28,158	126,153	94,825	11,367	106,192	232,345
1957	85,055	42,902	127,957	96,564	14,500	111,064	239,021
1958	79,753	46,809	126,562	95,707	16,170	111,877	238,439
1959	84,090	58,169	142,259	96,552	20,844	117,396	259,655
1960(Jan.-Oct.)	69,356	59,746	129,102	73,584	27,299	100,883	229,985

All figures are in long tons. Synthetic figures do not include latex. Source: International Rubber Study Group

Red buses were the first to use all-rubber suspension with rubber to metal bonded units, loaded in a combination of compression and shear. The combination of compression and shear is repeated in the Austin 7 and Mini-Minor.

Four-wheel Suspension

The Austin Gypsy was the first motor vehicle in series production to have independent four-wheel rubber suspension. The type of suspension used is the Flexitor unit, which has been widely employed on caravan and trailer units. The unit is superficially similar to a torsion bar but the bar is not anchored. A hollow steel shaft represents the bar and is bonded inside a sleeve of rubber which is in turn encased in a steel shell. Method of manufacture is such that rubber and bond are under compression thus increasing fatigue life. The trailing arm and wheel assembly is carried by the steel shaft which turns under load, the rubber taking the stress and returning to its original position when the load is removed. Natural rubber with a coating of synthetic lacquer is used in this unit.

The latest development in rubber suspension is the air spring which consists of a series of inter-communicating rubber containers. Although this idea is not a new one it is only recently that vehicles in Britain have been fitted with pneumatic suspension. The main advantage of the air spring is its adjustability to varying loads. Each spring is fitted with its own air tank and pressure in the containers can be varied to meet the requirements of load and road surface. This type of spring has great potential but at present difficulties in the air retention of the containers and production problems has prevented its widespread application. A number of heavy commercial vehicles have been fitted with these springs when specified, with reasonably successful results.

Improvements from Synthetics

The introduction of synthetics has led to an improvement in existing components and a greater use of rubber in vehicles. Special elastomers such as neoprene can be used for applications where oil is present, and even greater oil resistance has been achieved by nitrile which is being used for oil seals.

Butyl, resistant to atmospheric attack, has given an improvement in the weathering qualities of seals and radiator and heater hose, and its high hysteresis loss gives it good shock absorption. It has the disadvantage of developing permanent set under pressure.

TABLE 3
UK PRODUCTION OF CONVENTIONAL AND TUBELESS CAR COVERS

	Conventional	Tubeless
1956	4,508,797	2,928,628
1957	3,211,895	4,541,342
1958	3,888,712	6,064,723
1959	3,987,534	7,185,829
1960	4,184,333	8,669,688

Source: Tyre Manufacturers' Conference

Rubber in Aircraft

The story of rubber in aircraft is one of continual challenge. The demand is always for better rubbers capable of standing up to the ever-increasing rigours of performance. It is a demand which never slackens, never permits complacency.

Rubber in aircraft began with applications similar to those in the motor vehicles — sealing strip, anti-vibration mountings, and, of course, tyres. As in the motor industry the introduction of synthetics immediately widened the range of uses to which rubber could be put, and it is now a basic material in aeroplane construction.

Synthetics have enabled the rubber industry to cope with the evolution of the aeroplane in the provision of materials which will measure up to the requirements of higher speeds and

TABLE 2
UK TYRE INDUSTRY PRODUCTION

		1955	1956	1957	1958	1959	1960
Covers (new)	Cars	8,219,303	7,437,425	7,753,237	9,952,935	11,173,363	12,854,021
	Earthmover	46,230	52,597	52,608	41,928	47,849	52,786
	Land and road vehicles	253,475	189,149	199,086	208,943	271,475	281,888
	Agricultural tractor	715,284	542,331	815,850	713,760	812,589	855,978
	Commercial vehicle	3,003,888	2,659,029	2,580,224	2,209,777	2,564,455	3,549,562
	Motor cycle	971,525	823,140	1,145,633	743,270	1,135,785	932,310
	Bicycle	17,141,659	12,782,223	14,014,779	12,309,826	13,573,510	12,704,243
	Aero	90,363	117,858	72,678	65,614	75,396	74,731
	Scooter	N.A.	N.A.	N.A.	264,306	422,918	489,712
Tubes	Cars	5,648,037	3,015,490	2,463,117	3,216,947	3,740,721	4,227,200
	Earthmover	22,481	25,650	28,360	22,522	30,697	34,647
	Land and road vehicles	143,512	134,284	136,191	124,895	126,263	112,106
	Agricultural	692,074	487,845	722,954	722,411	823,025	883,135
	Commercial vehicle	2,294,978	2,014,069	1,894,920	1,788,438	1,988,301	2,351,462
	Motor cycle	984,061	702,821	1,068,668	770,634	1,126,402	924,530
	Bicycle	14,016,479	9,767,993	11,656,537	12,813,989	10,878,944	12,615,389
	Aero	49,481	61,198	47,247	41,098	30,541	29,183
	Scooter	N.A.	N.A.	N.A.	223,490	377,665	440,993
Remoulded Tyres	Cars	1,971,176	2,179,584	2,419,276	2,845,423	3,039,433	—
	Earthmover	2,957	3,416	4,903	6,167	6,023	—
	Land and road vehicles	21	145	469	2,134	694	—
	Agricultural	36,882	33,940	44,675	49,028	51,728	—
	Commercial vehicle	617,189	618,257	645,580	629,975	642,214	—
	Motor cycle	10,469	11,781	15,941	13,977	16,938	—
	Aero	17,081	27,767	33,073	24,378	21,605	—

Source: Tyre Manufacturers' Conference

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greater altitude. The main requirement is ability to function under extremes of temperature, which can require materials to operate at 300°C., or even higher, and be flexible in exposed conditions where the temperature drops to −75°C. Besides

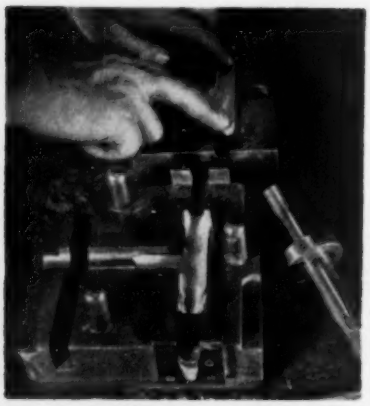


Fig. 2. Moulding T-piece for cowling seal of Bristol Britannia aircraft using I.C.I. silicone rubber

this the elastomers may also require properties of oil and chemical resistance, resistance to cosmic radiation and ionized gases and stability under extreme pressures and in vacuum.

The requirements for elastomers in air and space travel are widely varied, and each has its own unique problems. These include: —

(a) Aircraft Tyres.

These have to be tough, and have high impact resistance for landing (temperatures may go as high as 350°F. or more within a few seconds immediately after landing). In addition to this, high speed aircraft develop high temperatures in flight, so that even when the tyres are resting they will still be subjected to high temperature oxidation which they must be capable of withstanding, so that on landing they still perform satisfactorily. Apart from the rubber in the tyre, the reinforced carcass must also be able to withstand such temperatures, both on landing and during flight, which means that conventional fabrics used in tyres will have to be replaced by more heat-resistant materials such as metal. The vehicle may be stored in sub-arctic conditions and be required for service at any time, so the tyre must retain its flexibility at low temperature to be ready for take-off at any time. Therefore, it must not freeze and develop flat spots, making take-off hazardous.

(b) Wire and cable insulation and protective sheathing.

These are important applications for rubbery materials, particularly in view of the amount of electrical apparatus and circuits used in modern aircraft, rockets and space vehicles. This insulation and sheathing must be capable of withstanding all the conditions that the vehicle will meet, both high and low temperatures; it must be non-flammable, firstly in case there is a short-circuit, and secondly so that, if fire does break out, electric circuits will still operate as it may be arranged for them to activate systems for bringing flame-extinguishers into action. Wire and cable insulation should also be oil and fuel resistant.

(c) Surface Coating Materials and Adhesives.

Such materials are often exposed to severe abrasive action by friction, extreme temperatures and cosmic radiation, and therefore are expected not to disintegrate or harden during performance.

(d) Oil, Fuel and Heat-resistant Components and Mountings

The performance of high efficiency engines and motors is as dependent upon the rubber components present as on any other unit in their make-up.

(e) Fuel Tanks, Tank Linings and Sealants

In this application it is obvious that the rubbery material used must be capable of meeting the conditions of service with a very wide margin of safety. The resistance of rubber to fuels, particularly at high temperatures — as high as 300°F. — is one of the most difficult problems facing the technologist. The liquids being used or considered are inhibited red fuming nitric acid, unsymmetrical dimethyl hydrazine, di-isopropenyl acetylene, anhydrous hydrazine, ethylene oxide, normal propyl nitrate, gaseous fluorine, chlorine trifluoride, 90% hydrogen peroxide, and nitrogen tetroxide.

(f) Various miscellaneous components such as accumulators, O-rings, hose and tubing, suspension systems, window and door latch and bomb-bay seals, flooring, furnishings and clothing. These components will be subjected to various conditions, both in service and at rest. They must therefore be versatile, and to some extent chameleon-like in their ability to change their properties according to conditions, because the performance of present-day vehicles is such that conditions can change quite rapidly, and each individual component must follow them closely.

(g) Solid Fuel

The possible use of rubber as a propellant has advantages over liquid propellants in that the rubber can act as a fuel and the mixture of perchlorate or nitrate oxidizer and rubber can be cast into position. The liquid polysulphide rubbers have proved to have the most desirable properties in this direction.

Vital Functions

Some of the above applications may appear to be relatively insignificant in the successful operation of an air or space craft. This, however, is misleading because most of them have vital functions, and failure of any one component in service could cause immediate destruction of the whole vehicle.

Table 4 shows the main elastomers available and gives a guide to their properties. Suitably compounded natural rubber, in which fatigue life is better than synthetics at present, is used for engine and instrument mountings. Natural finds its greatest application for tyres. For the more stringent technical requirements synthetics can provide the only adequate answer.

Nitrile with its resistance to petroleum products probably accounts for the largest share of the total of synthetic rubber in aircraft, and the largest single application of this has in the past been in flexible fuel

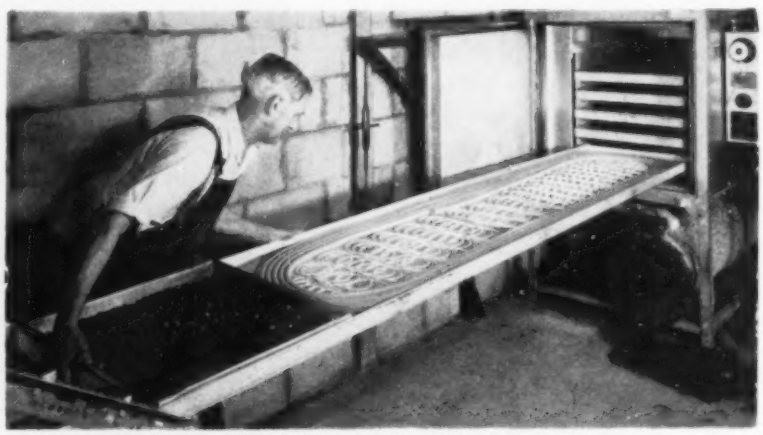
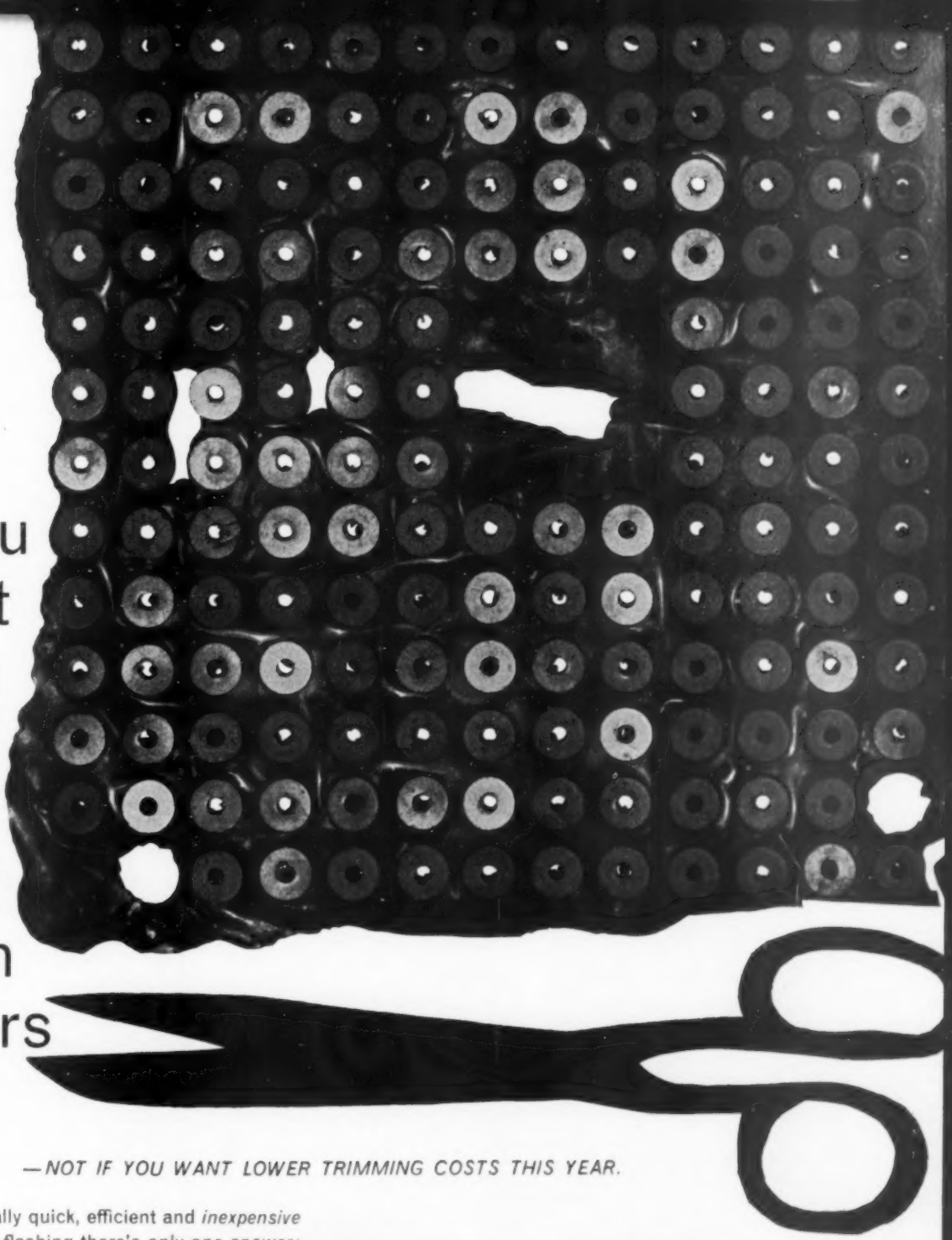


Fig. 3. Inserting silicone-rubber parts into curing oven



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tanks. However, the weight factor is ruling it out now for this task. It is also used for hose linings, seals and diaphragms where its resistance to fuels and oils is utilized. Nitrile's average maximum working temperature is a disadvantage as conditions become more arduous, and it is being superseded by more specialized synthetics. For instance, silicone rubber seals, moulded and bonded components are being widely used at temperatures in the region of 250°C. upwards.

The outstanding property of all silicone rubbers is their ability to withstand continuous exposure to wide extremes of temperature with little change in physical or dielectric properties. Unlike natural or organic rubbers, silicone rubbers do not melt or char when exposed to temperatures as high as 250°C. yet retain their elasticity at temperatures lower

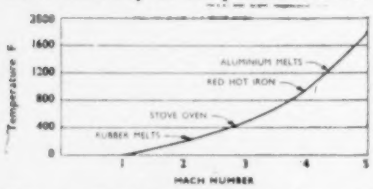

Fig. 4. Environmental aerodynamic heating at 35,000ft.

even than – 50°C. They decompose slowly at temperatures above 300°C., leaving an inert non-flammable and electrically non-conducting residue. Probably more than 90% of the applications for silicone rubber follow from this property. While satisfactory in contact with certain mineral oils, silicone rubber is not generally so resistant to aircraft fluids. A breakthrough in the field of oil-resistant silicone rubber has been the advent of a fluorinated silicone rubber which possesses resistance to the swelling effects of aircraft fuels, hydraulic fluids, petroleum based engine oils and certain solvents together with heat stability.

Butyl, resistant to ozone and acid and having low air permeability, is used for the inner tubes of aircraft tyres and for use in outside seals. However, butyl is broken down or degraded when exposed to conditions of radiation which would preclude its use on space aircraft.

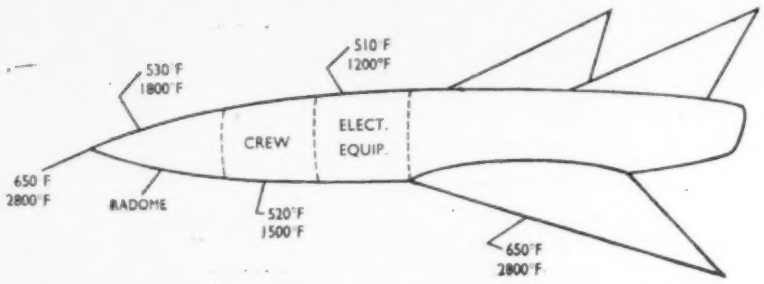

Fig. 5. Typical airframe operating temperatures. Top figures: flight at three times the speed of sound at 50,000ft. Bottom figures: flight at seven times the speed of sound at 100,000ft.

The most important recent development has been in the field of fluorocarbon elastomers. Polyetrafluorethylene is not strictly an elastomer, but its high temperature resistance has made it a useful replacement for rubbers for use above 250°C. Other polymers of this type have been developed to give the properties of elastomers, and Viton A, the copolymer of vinylidene fluoride and hexafluoropropylene is one example now used in commercial quantities.

This type of polymer, which contains as much as 65% fluorine, has remarkable heat resistance and is serviceable over the approximate range – 40°C. to 250°C. Its other properties include chemical inertness, resistance to a wide range of oils and fluids, ozone resistance, good mechanical properties, and excellent resistance to compression set at high temperatures. Fluorinated rubbers, however, are very expensive.

Modifications of existing polymers can only be regarded as a holding operation and are unlikely to keep pace with future conditions. Some idea of the extreme operating temperatures is given in Figs. 4 and 5. Work along completely new lines is being undertaken. To widen the serviceable temperature range the field of inorganic polymers is being investigated, and systems based on boron, phosphorus, nitrogen and beryllium show the most promise for thermal stability, but a rubber-like material is not yet available.

The Future

In the motor vehicle field the emphasis is in the future likely to be on speed—and on rubber's ability to give tyres which are capable of high speeds yet retain a good average life, and competent road-holding. Below the high-speed level the emphasis will probably be on satisfactory wear and improved safety, with the new 'cling' rubber making an important contribution to the latter demand.

On the component side, development will concentrate on the improvement of life and performance, and there will be advances in the use of rubber for suspension.

The future for rubber in aircraft is dependent on its ability to measure up to the increasing severity of its working conditions. The problems are of extending the temperature range of rubber components while retaining the physical properties which are their *raison d'etre*. The answers may lie in the improvements of existing polymers by a major advance in polymer technology, or by the creation of inorganic materials with rubber-like properties. Much remains to be done, but success must be achieved if rubber is to retain its place among the basic materials of aircraft construction.

TABLE 4
GUIDE TO THE PROPERTIES OF ELASTOMERS

	Natural Rubber	Butadiene Styrene	Neoprene	Nitrile	Butyl	Polyacrylic	Silicone	Fluoro-carbon
Tensile strength	A	A	A	B	B	C	D	B
Tear resistance	A	A	B	C	A	C	D	B
Abrasion resistance	A	A	B	B	B	C	D	B
Compression set	A	B	A	A	C	C	A	A
Resilience	A	C	B	C	D	D	B	C
Low temperature flexibility	B	B	C	C	B	C	A	C
Outdoor ageing resistance (unstressed)	C	C	A	C	A	A	A	A
Ozone resistance (stressed)	D	D	A	D	A	A	A	A
Heat resistance (Max. working temperature)	D 80°C.	D 80°C.	C 100°C.	C 100°C.	C 120°C.	B 150°C.	A 250°C.	A 200°C.
Flame resistance	D	D	A	D	D	D	C	A
Resistance to mineral oils	D	D	B	A	A	B	C	A
Resistance to ester-based lubricants	D	D	D	A	C	C	C	A
Resistance to high aromatic solvents and fuels	D	D	C	B	C	C	D	A
Electrical resistance	A	A	C	C	A	C	A	B

A = Excellent B = Good C = Average D = Poor

Rubber and Plastics in Transport

Growth of RF Welding

COMPONENTS FROM SEAT COVERS TO SUN VISORS PRODUCED

By R. STILTON, Radio Heaters Ltd.

TEN years ago, small components which had been manufactured by the use of plastic sheet welders, were used in various forms of transport. These included small grommets around the bases of gear levers in motor cars, and various other small components such as these.

In July 1954 what was then a very large radio frequency press welder was installed in the Castle Bromwich factory of Fisher and Ludlow Ltd. This unit was used for the bonding of quilted designs on motor car door trims, and was, in fact, the first unit of its kind to be used in this country.

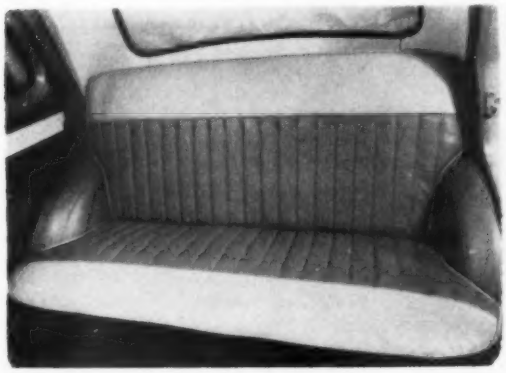

Fig. 1. Welded back seat and squab of a Standard Ensign. In this unit only the fluting is welded, all the seams of which are bonded at the same time

Photo: Standard-Triumph

This Radyne press welder was the forerunner of a very large number of similar units which have been supplied to all British motor car manufacturers and their suppliers. Many other similar units have been exported, even to the American Continent.

The motor car industry now uses radio frequency welders with generator output sizes varying from 100 watts to 30kW, and with these machines they are, amongst other things, producing the following components:

Sun visors, transparent back and quarter lights, edgings for carpets and gear lever apertures, tool rolls, arm rests, cushion and squab seating units, step coverings, door pulls, hood linings, spare part packs, instruction manual covers, loose seat covers, licence covers, wheel arch covers, and aprons for use of employees in plating and paint shops.

Radio frequency welders are also used for assisting in the manufacture of other components, such as the pre-creasing of leather panels prior to their being stitched into flutes for seating units. By this method of pre-creasing, the fold lines are permanently embossed in the leather, allowing mass production methods to be adopted. Heavy duty supported plastic materials are also sometimes pre-creased by radio frequency methods, to enable the fold between the flutes to be more accurately processed.

In addition to motor cars, other forms of transport are fitted with components which are produced with the aid of radio frequency welders. These include decorative wall panels of PVC bonded to hardboard with the aid of a suitable heat setting adhesive, and these are used in coaches, caravans, and even Atlantic liners.

Continuously produced quilted plastic materials are also made and used for similar purposes. Bed-head panels are a typical example of the application for which this product can be used.

A large number of coaches are fitted with decorative side panels which are made from continuously quilted material or bonded boards.

Aircraft are being made with radio frequency seating units, and in this instance fabrics, such as uncut moquette, are used as the top or face material. The bonding of this is achieved either with the use of an adhesive or by using vinyl foam as a quilting media. If this is used the foam flows into the fibres of the fabric during the welding cycle, thus forming a satisfactory bond.

On trains, welded seating units are currently being put to the test, and the use of welded supported vinyl is also being considered for window blinds.

The High-Frequency Welding Process

High-frequency welding of plastic is actually another method of heat sealing, except that a generator which converts normal electrical mains to a

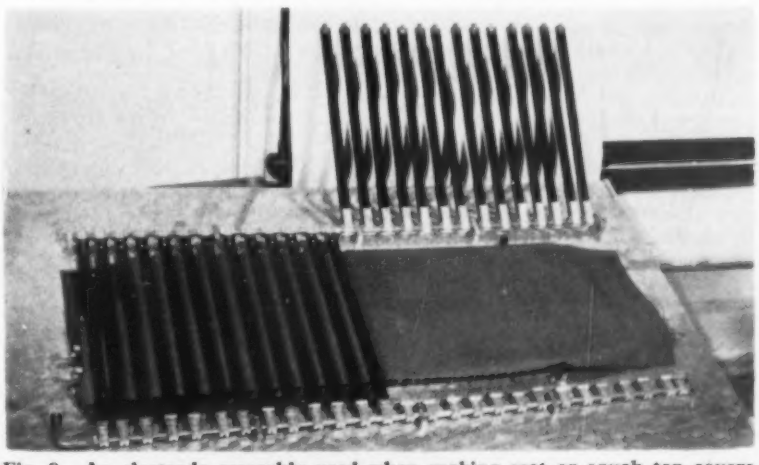

Fig. 2. An electrode assembly used when making seat or squab top covers which require a given depth of fluting. The top material is placed on the welding surface of the electrode, and fluting bars are placed individually in sequence prior to the welding cycle. The foam or other quilting medium and base material are placed on top of the 'fingers' before the welding cycle, and the latter are removed after welding by a special quick-release mechanism

very high frequency is used. The materials which are to be bonded or welded together are clamped in a special press between dies or electrodes, and the high-frequency power from the generator is applied to the electrodes. If the material being welded possesses the necessary 'loss factor' it will absorb energy from the high-frequency field passing through it. This energy which appears as heat in the material is caused by molecular friction in the material being bonded and thus the temperature is raised very rapidly to fusion point of the surfaces of the sheets being bonded. Since the electrodes are kept cold, or relatively cold, the surface of the sheeting is therefore kept cool, and thus the maximum temperature is on the inner faces of the material being bonded.

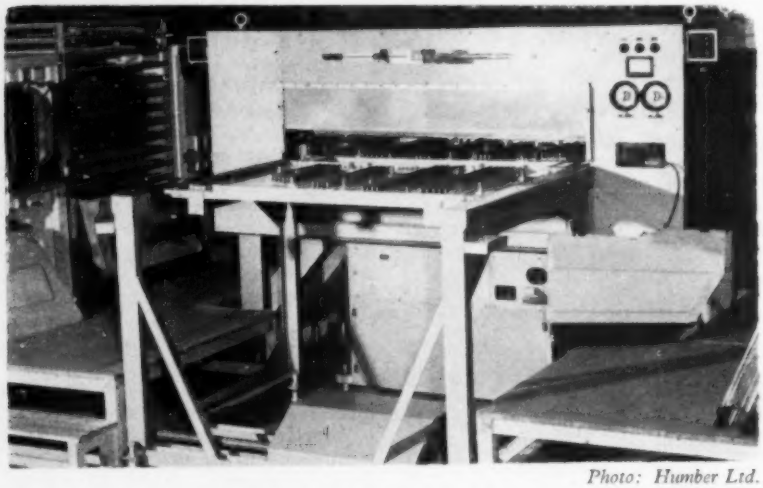

Photo: Humber Ltd.

Fig. 3. Fully-automatic indexing double shuttle loading assembly on a large Radyne press welder

Correct Heat Dosage

High-frequency welding is consequently a unique method of sealing or bonding, and does not depend on conduction of heat from outside to the inner layers of material.

To obtain a satisfactory weld, *i.e.* the correct heat dosage, it is necessary to apply the correct proportion RF power, time of the heating cycle, the length of any after-dwell or cooling cycle, and the pressure exerted on the materials being welded by the electrodes.

On most modern press welders, the welding cycle, after-dwell cycle if required, and pressure can be accurately adjusted and controlled.

Roller welding machines have been designed and are, in fact, in a very few instances in current use. It is extremely difficult with the so-called 'continuous' welder for reasonable welding speeds to be maintained, especially on thick lay-ups of material, and at the same time guaranteeing consistent welds. It has been found much more practical to weld a definite length of material in a single 'hit' or operation by using electrodes or dies to the shape of the weld required, so that even pressure and heat can be applied to the whole of the weld being made, in a single, quick operation. Where welds are required that are beyond the capacity of the machine being used, it is, of course, possible to continue the weld by moving the sheets through the electrode assembly, and make a series of successive welds. Equipment is available which performs this function automatically as well as controlling heat, pressure, etc., also automatically.

The main advantage of a press weld system over roller welding is in the fact that very complicated shapes and quite extensive areas can be welded in a single operation with repetitive accuracy, if the welding tools or dies are made to the desired shape or contour.

Materials

Many thermoplastic materials are readily heated in a radio frequency field and are consequently suitable for high-frequency welding. These include most grades of polyvinylchloride and vinyl-based compounds. The weldability of a material depends upon the 'dielectric loss factor' of the plastic material. Materials with a very low 'loss factor' are not suitable for high-frequency welding, although the recent advent of generators operating at very high frequencies has increased the range of weldable thermoplastic materials. Materials such as polythene, polystyrene and polytetrafluorethylene are not in general suitable for welding with current types of high-frequency welding equipment.

The overall 'loss factor' of the material generally increases with the plasticizer content, and is also to some extent affected by the type of plasticizer which is used in the thermoplastic material. Although it is possible to weld unplasticized PVC sheeting by high frequency methods, it is sometimes an advantage to use preheated electrodes. Whether or not this is necessary depends on the operating frequency of the generator being used, and the speed at which the weld has to be made. It must, however, be remembered that the operating frequency cannot be altered at will.

In general, however, the materials mostly used in the motor car and other industries, and which are to be high-frequency welded, are unsupported and supported plasticized PVC sheetings which can be bonded through

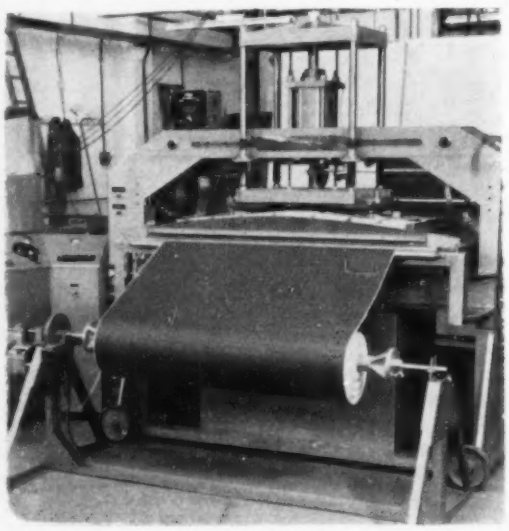

Fig. 4. The Radyne W 3P press welder fitted with a fully-automatic indexing attachment for processing material directly from the roll

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Compoflex Hoses are made by Compoflex Co. Ltd using Hycar nitrile rubber.

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- Easier handling: their light weight saves time and effort.
- Increased durability: they need less frequent replacement, cutting maintenance costs.

Hycar nitrile rubbers are proving their superiority in a host of everyday applications ranging from shoe soles to aircraft fuel tanks.

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Wherever Oil meets Rubber—Hycar meets the need

quilting media to other materials, either directly or with the use of a heat setting adhesive. It is obviously an advantage where economically possible to use materials which will bond to themselves, thus saving the need for an adhesive to be used.

Machinery

Because of the widely varying applications for which plastic sheet welders are used in the transport industry, the numbers and types of machines are widespread, varying from small hand-operated plier-type applicators fitted to RF generators giving an output of approximately 200 watts, to very large press welders coupled to generators giving an output of 30kW.

Over recent years the production of vehicles has expanded very rapidly, and this, coupled with an increase in premium on floor space, has made it necessary to obtain maximum production from each unit employed on specific applications. Consequently, many of the larger units, and indeed some of the smaller equipment, have been fitted with fully or semi-automatic loading assemblies so that the press welder itself is fully occupied. In other words, a team of operators is employed in feeding materials into special indexing units of one sort or another, so that they can be constantly fed into the press for the actual welding cycle.

A Few Seconds Cycle

This is necessary as in the vast majority of times, if not in all cases, the complete press cycle is normally completed in a few seconds, whereas the loading operation may take somewhat longer.

One of the most commonly used mechanisms of this type is the Radyne automatic double shuttle loading assembly which feeds work from alternative sides into a through-type press. It is only necessary for the operator to load the work on to the tools or tray on one side of the press and to initiate the movement of the tray into the press, and to subsequent welding and dwell cycles, by pressing a button. Manually operated versions of this type of assembly are available. A recent innovation allows for four-tray loading which gives maximum utilization of the press with most economical capital outlay.

This method covers the fitting of the press workplate diagonally with respect to the press frame instead of the normal transverse arrangement. By changing the workplate to the normal conventional type, the machine can easily be converted to a standard through-type press which can accept and weld material up to 54in. wide.

Other types of fully or semi-automatic loading can be supplied where it is necessary to weld materials directly from the rolls. In cases like this it is necessary to fit index units which grip the material on either side of the workplate and progress a precise distance through the press between consecutive welds.

Users of RF Machinery

Machinery such as that described in this section is currently being employed by the British Motor Corporation, Ford Motors, Fisher and Ludlow, Pressed Steel Company, Standard-Triumph, Jaguar, Vauxhall and Rootes, as well as numerous suppliers to the transport industry.

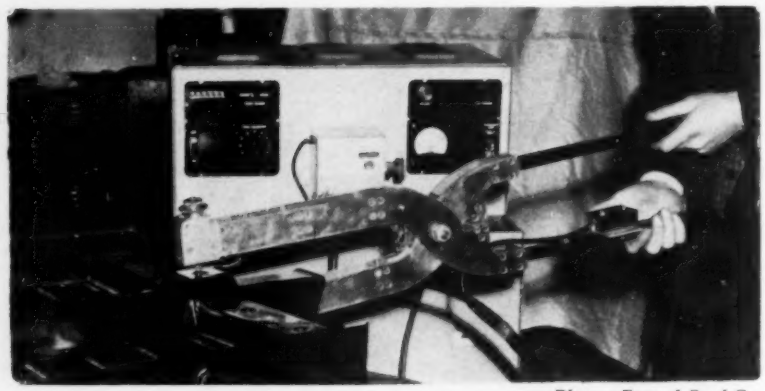


Photo: Pressed Steel Co.

Fig. 5. Specially-adapted plier-type hand applicator used for spot-welding plastic mock-ups

Sole Resin

Durez has produced a resin (21424) which produces a lighter colour in shoe sole stocks. Typical sole and heel formulas can be obtained from the UK distributors, Omni (London) Ltd., 35, Dover Street, London, W.1.

RIDING ON RUBBER

Travellers on the new 'all silver' tube trains which have recently been introduced on some underground lines by London Transport, will probably be unaware that they have been riding on rubber. These trains are the first in Britain to be suspended on rubber and the design used was developed by the London Transport Executive and Metalastik Ltd.

The object of using rubber is to reduce maintenance costs by eliminating lubrication and to provide a more comfortable ride with reduction of noise. A reduction in weight, with a consequent saving in fuel consumption, is also made.

The bolster suspension used incorporates two rubber bonded-to-metal springs in an inverted V formation which provide for the vertical loads, the longitudinal loads due to traction and braking and the transverse loads due to sideways movements in one simple arrangement. These are required to have different deflections for the three directions in which they are loaded and this is achieved by the angle at which they are set so that the ratio of shear to compression loading on them varies with the direction of the applied force.

The conventional axlebox suspension is also replaced by a rubber-to-metal bonded unit of special design in a chevron shape which helps to eliminate wear and lubrication and also damps out vibration due to the rail joints. Laminated steel springs do not respond quickly enough to absorb this form of vibration.

Moving Pavements

Pavements may become part of our transport system, after the successful use of 'moving sidewalks' in America.

An estimated 2.5m. people have ridden on a moving rubber pavement in Houston, USA, since it began transporting passengers six years ago.

The moving rubber surface carries visitors 114ft. up a steep incline to one of the main entrances of the Houston Coliseum. It is actually a B. F. Goodrich conveyor belt, widest ever used commercially to transport people. It travels on closely-spaced steel rollers which give passengers a smooth, effortless ride.

Celanese Resins

Celanese Polymer has developed a new line of high density polythene resins. Called 'Fortiflex R,' the new resins are said to offer great toughness and processing versatility for a broad range of product applications.

Electrical Aids in Industry *Data Sheet* **No. 16**

Speed control of Electric Motors

'Variable' speed may involve two or three (or more) speed steps or infinitely variable (stepless) speed control. It is this latter type which is considered below. Of the many advantages of electric drives, the opportunity offered for infinitely variable speed control is outstanding. Unfortunately this advantage is not used as much as it might be to increase the speed of working, and to improve productivity and quality.

Principal Factors Affecting Choice of Drive

(a) First cost, (b) Efficiency, (c) Speed range, (d) Regulation, (e) Power-to-weight ratio, (f) Availability of supply, (g) Maintenance and reliability, (h) Change in power and torque over the speed range, (i) Simplicity of control gear, (j) Effect of variation in supply, (k) Power factor, (l) Characteristics of the load, (m) Operational environment, (n) Braking requirements.

This list is not meant to be all-embracing, for there well may be factors not mentioned which could prove conclusive in the choice of a drive.

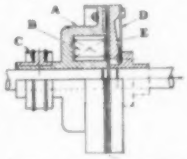
The following are some methods of obtaining infinitely variable speeds:

Alternating Current Motors

The vast majority of electric drives in use today employ A.C. motors. Although not quite so flexible as D.C. motors in the matter of speed control, there are available many types which give a large measure of speed variation.

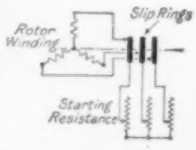
INDUCTION MOTORS. Although the squirrel-cage motor is essentially a constant-speed machine, it is much used for stepless variable speed drives with one of the following types:

(a) Eddy-current coupling,
(b) Ferro-magnetic particle coupling,
(c) Mechanical drives, e.g. belt drives and friction drives,
(d) Hydraulic variable speed drives.



A. Magnet body; B. Magnet coil; C. Collector gear; D. Spring plate; E. Armature.

SLIP-RING MOTOR. The slip-ring motor, which costs more than the squirrel-cage motor, can be varied in speed by means of the resistors in the rotor circuit used for starting. The amount of resistance in circuit can be varied in steps by means of different forms of control gear operated by hand, push-button or automatically controlled contactors.



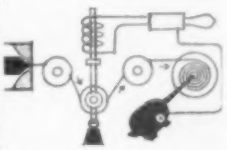
A.C. COMMUTATOR MOTORS. These are three-phase induction motors provided with additional windings which, through a commutator and brushes, permit speed adjustment in either direction below and above synchronous speed. The brush gear can be automatically controlled so as to vary the speed according to a known programme or cycle of operation such as in spinning frames. The Schrage and similar motors are refinements of this type.

Ward-Leonard System

In this system the armature of a D.C. motor is supplied at variable voltage from a separate generator. The generator may be driven by an A.C. or D.C. motor directly coupled to it and to an exciter which supplies the field windings of the generator and main motor. By means of a potentiometer resistance, with mid-point connected to one terminal of the generator field windings, the generator voltage may be varied from maximum to zero.

Electronic Motor Control

Motor speeds can be controlled accurately by electronic methods. Such drives can respond in any desired manner to variations in one or more variables and several drives can be interlocked so that their speeds are always in the same ratio. A typical application is on several separate conveyors. The system can be speeded up or slowed down from a 'master' controller, but for 'running in' purposes the speed of each drive can be individually regulated. Electronic speed control has been successfully applied where human control is not possible, e.g. in register control. In this example print must always be placed at exact positions on packaging material. The sketch shows electronic control of wire tension in drawing operations.



Direct Current Motors

While it is unlikely that a mains supply of D.C. will be available, the striking advantages of D.C. motors sometimes make it worth while installing a rectifier, e.g. a motor-generator set, a mercury-arc or a semi-conductor. The speed of D.C. motors is easily controlled by inserting a resistance in series with the motor. Although this can result in a certain amount of wasted electricity, the benefits derived will often heavily outweigh such losses.

For further information get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Telephone: TEMple Bar 9434.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available —'Electric Motors and Controls' is an example.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

CUT HERE

Rubber and Plastics in Transport

Prospects for Rubber in Roads

CONTROLLED EXPERIMENTS SHOW CONSIDERABLE POTENTIAL MARKET

P. D. THOMPSON, B.Sc.,
Natural Rubber Bureau

MOST road engineers are now well informed both on the detailed properties of rubber-bitumens and tars and the laying procedures for these — thanks to the many articles on the subject which have appeared in technical journals and in the publications of the Natural Rubber Bureau. There are, however, a number of general questions which are frequently asked at lectures and in correspondence and from these some have been selected which are of particular interest to the rubber industry.

What is the Potential Market for Rubber in Roads?

A rubberized road generally contains from 1-4% by weight of rubber to the weight of the binder, although up to 15% can be used in mastic asphalt. This means a rate of 1lb. per 50 sq. yd. for spraying and chipping treatment and 1lb. per 9 sq. yd. approximately for bituminous macadam. The quantity of rubber seems small but it must be remembered that there are 190,000 miles of paved roads in the UK and well over a million miles in the USA alone. If all this mileage were maintaining 'rubberized' binders it would in fact absorb some 22,500 tons of rubber in the UK, 135,000 tons in the USA and over 70,000 tons in Western Europe annually.

Obviously we do not foresee, nor would we recommend that all or most of these roads should be rubberized. It is, however, clear from these somewhat academic figures that a very respectable market for rubber in roads remains to be developed, even if only a small percentage is so treated.

How is the Market Developing?

Though it is now expanding satisfactorily the consumption of rubber in roads has so far remained limited for the following reasons. The authority responsible for the upkeep of roads is generally hard put to it to carry out its job using even the cheapest materials, budgeting on a year-to-year basis — so much to do, so little cash to do it with. It is naturally hesitant to use a more expensive material until it is convinced that this is justified not only on a long term but, often on a short term basis as well.

Some extra expense may also be incurred since the very properties which the rubber is intended to produce, that is elasticity and reduced temperature susceptibility, make laying a somewhat more difficult operation, while temperature control must be precise to avoid degradation of the rubber.

Although laboratory investigations show advantageous properties, these have to be confirmed by closely controlled full-scale experiments on the road. As a good surface dressing lasts five to 10 years and a rolled asphalt up to 20 years or longer, proof of the overall saving in pounds, shillings and pence by the use of rubber takes many years to collect.

But all the indications are that the future prospects are good. It is particularly encouraging that there have recently been so many repeat orders from commercial users who have become convinced of the merits of rubber by the performance of their own earlier trials.

In the UK, USA, South Africa, Australia and Europe the consumption of rubber for road use is rising steadily. Space does not permit an analysis of all these markets, and exact figures are difficult to collect. But, to quote one example to illustrate the trend, one of the foremost suppliers of rubberized binders for surface dressing reports that consumption of rubberized cut-back has risen steeply in the past three years.

Overseas, the potentialities of rubber are typified by some recent comments of C. C. Perrin of the Victorian Country Roads Board, Australia. Describing a test carried out on the busy Hume Highway, Mr Perrin stated that a very marked difference was soon apparent in the section of work in which rubber-bitumen was used. He added: 'The rubberized work is now in very good condition whereas considerable stripping of the stone had taken place in the adjacent sections on which normal bitumen was used.'

What is Being Done to Increase the Use of Rubber?

It is clear that the future progress of the rubberized road is largely a question of economics. Research in this country is therefore divided into two main categories. The first is concerned with ensuring that the rubber is used with the maximum efficiency, the second consists of full-scale trials to assess the lasting qualities of rubberized materials in comparison with conventional binders. The Natural Rubber Bureau's research team, working at the Road Research Laboratory, are actively pursuing the problems of improving blending and laying techniques.

Recent developments have included methods of analysing rubberized binders so that we now have a better

Rubberized roads get the tough jobs . . . rubberized slurry seal laid over premix on the Athlone Bridge over the Umgeni River, Durban, South Africa

New Way to Lighten Overloaded Budgets

EYE-CATCHING COLOR is essential in the manufacture of many products, but particularly so in rubber housewares. Equally important in the highly competitive housewares market is the matter of cost.

NOTICE HOW the housewares above—made by an established leader in the field—blend colorful good looks with readily apparent value. A key reason for their sales success: they're based on PLIOFLEX 1713, new oil-extended synthetic rubber by Goodyear.

USED IN COMBINATION with other rubbers, PLIOFLEX 1713 was chosen for its excellent color characteristics, ease of processing, high uniformity and low odour level. What's more, it costs less per pound than previously used polymers, yet maintains end product quality.

PERHAPS NEW PLIOFLEX 1713 can improve product and lower costs *for you*. For more information on PLIOFLEX 1713, PLIOFLEX 1714—another new 50-part oil-extended rubber—and a full line of synthetic rubbers and rubber chemicals—see your Goodyear Chemical Distributor.

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understanding of what happens to the rubber. A new blending technique for cut-backs has resulted in the more efficient use of rubber (as latex) without foaming, which should substantially cheapen the final product. Road trials are being started every year, and several more, including the use of the new technique, are planned for the coming season.

Rubberized roads get the tough jobs . . . putting down a rubberized surfacing on the upper hairpin of Porlock Hill, one of the steepest gradients in the UK

What Does One Get for the Extra Cost?

The well-known reduction in temperature susceptibility induced in a binder by the addition of rubber has been shown, in full-scale experiments, to result in a much-reduced tendency on the part of the rubberized binder to flush-up and results in better adhesion of the stone to the binder. Premature failure is therefore much less likely. Rubberized mastic asphalt has also proved less liable to reflection cracking over concrete bases. Thus in a very few years the rubberized road is likely to show to marked advantage as regards maintenance costs, to say nothing of reduction in traffic hold-ups due to repair work.

Rubberized roads get the tough jobs . . . rubberized asphalt laid over a concrete foundation on Birmingham's heavily trafficked new inner ring road

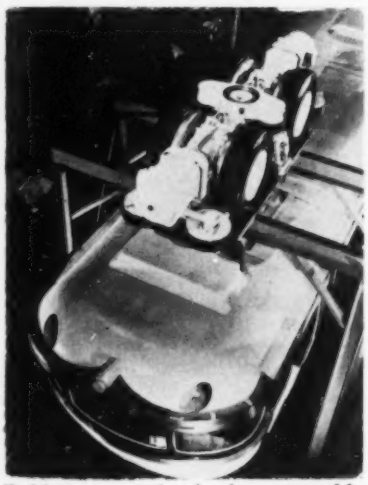
Discussing longer term benefits, the well-known Dutch engineer, A. F. W. Wildeboer, has given in a recent article some interesting figures illustrating economics effected by the use of rubberized materials. For example, Ryksweg 1, Noarden, Bussum in Holland, given a thin rubberized wearing coat in 1936, had one minor repair in 23 years (due to a girder falling off a lorry). The saving by 1959 was Hfl. 2.94 per M^2 (4s. 4d. per sq. yd.) compared with the adjacent non-rubberized road surfacing.

What Type of Rubber in What Type of Road?

The most efficient form of rubber for modifying road binders is undoubtedly latex, although it requires careful control to avoid foaming when added to hot bitumen. Both lightly vulcanized and unvulcanized powders have given good results when dispersed properly. For surface dressing and bitumen macadam where a cut-back is used, latex is to be preferred. A new process referred to below obviates foaming difficulties. In the case of mastic asphalt, laid at about 400°F., powder is the only practical form of rubber to use. Unvulcanized powder disperses quicker, but the coarser, vulcanized powders give excellent results which appear to resist breakdown better. For other mixed materials where penetration grade bitumens are used, the choice will depend on the ease of use and economic factors. Added to the mixer, unvulcanized powder and sprayed in latex disperse quickly. Added to the binder, the cheaper vulcanized powders may be more economical. Recent examples of tough jobs, where the use of rubber has solved a problem, include the resurfacing of Porlock Hill — gradient 1 in 4; of air strips in Australia; of heavily trafficked roundabouts in Birmingham and elsewhere, and the laying of rubberized roads over weak foundations such as peat and treacherous surfaces such as wood blocks. The growing tendency for road engineers to specify rubberized surfacing in such difficult conditions is a clear recognition of its superior performance.

GOING OVER THE TRAFFIC

ONE of the most interesting attempts to solve traffic problems in large cities is by the monorail overhead transport system — based on the idea that if you cannot go through the traffic, you can go over it. A French group, the Société Lyonnaise des Eaux et de l'Eclairage, has built a kilometre long experimental track at Orleans, on which it operates a demonstration car. This car is suspended from a silent-running, rubber-tyred bogie.



Rubber - tyred bogie assembly mounted in position on the monorail car

Each bogie includes four bearing and four guide wheels fitted with steel reinforced tyres inflated with nitrogen. Although blow-outs are rare, each wheel is fitted with a steel safety flange so that, if a tyre is deflated, the train can reach the end of the line.

Towns in Europe, and North and South America are said to be interested in this development, and, in fact, the plans to build an overhead metro in Los Angeles are now nearly complete.

Rubber and Plastics in Transport

Developments in Reinforced Plastics

TRANSPORT INDUSTRY USES HALF TOTAL GRP PRODUCTION

By BRIAN PARKYN and ERNEST OSTWALD, Scott Bader and Co. Ltd.

THE evolution of man can be traced from the time when he first mounted a horse, to the present day when he is almost ready to launch out into space. During the last century the growth of transport has been extremely rapid, and nowadays transport, in all its forms, has gained so much in importance that the economies of all countries are geared to the efficiency of their transport facilities.

It is hardly surprising therefore that the transport industries have always been in the forefront of technical developments. The advent of plastics made a considerable impact on transport and the rapid expansion of the plastics industry today is to a certain extent dependent on modern transport requirements.

Glass fibre reinforced plastics have played an important, albeit a small part in the recent history of transport. Glass fibre has been known and used for many centuries; in fact it was used by the ancient Egyptians before glass in any other form was known. Plastics reinforced with fibrous fabrics are also much older than is generally believed: when our forefathers covered wooden framework with hessian and painted this with pitch or other resinous material to make waterproof coracles, they were using a reinforced plastic material. It would therefore not be wrong to state that transport gave birth to reinforced plastics.

War Provides Impetus

Polyester resins were developed in the early 1930s by the electrical industries, which have played an important part in the development of plastics in general in their search for better insulating materials. Polyester resins reinforced with glass fibre were first used during the second world war, when this combination of materials proved ideal for the construction of radomes. The excellent electrical properties permitted efficient use of radar apparatus, and the mechanical properties of these low-pressure laminates gave good protection to the sensitive instruments. After the war the aircraft industry continued to develop the use of polyester/glass fibre for other applications. The part played by this industry cannot be emphasized enough.

Until the early 1950s the aircraft industry was the only one in this country paying any serious attention to the potentialities of reinforced plastics, and many of the techniques and processes in general use today were pioneered in the plastics departments of aircraft companies. Aircraft radomes today are still made with polyester resin and, in addition, air and de-icing ducting, interior fittings and seating, and even some structural parts, are also made of reinforced plastics. Because of the high thermal requirements of modern supersonic aircraft and missiles, resins of improved heat resistance are now frequently used in reinforced plastics applications in aircraft. The industry is therefore once again leading the development of the reinforced plastics of tomorrow.

Prototype service stage vehicle built almost entirely in Crystic 196/glass fibre by double skin construction by Eastern Coachworks Ltd.

Aircraft Lead the Way

Ten years ago aircraft accounted for more than half the total polyester resin production in this country; today it uses only about 5%. In 1959 the number of civil aircraft made in UK was 116; assuming that this rate of production will continue and that each plane can contain up to two tons of reinforced plastics components, this presents a future market of about 200 tons per year. Naturally it is not possible to assess the potential uses in military aircraft and missiles.

The first applications of polyester/glass fibre outside the aircraft industry were in the boat building industry. Timber has been used for centuries in this field, later to be partly replaced by steel and light alloys. Conventional press moulded thermosetting plastics were uneconomic even for small boat hulls until very recently. The boat building industry quickly recognized the potentialities of a material which could be moulded without the application of high pressure and therefore with relatively simple and inexpensive equipment. Polyester/glass fibre being non-metallic would also not be subject to corrosion, which caused a great deal of regular cleaning and painting; marine borers would not attack it and boat hulls could be moulded in one piece.

A few enterprising companies took a serious interest, and before very long boats of impressive size and of excellent design took to the water. The early mouldings may seem rather crude by present-day standards but

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they served an important purpose. Experience was gained from failures, new resins with considerably better water resistance were developed and fabricating processes perfected. Today polyester/glass fibre has replaced conventional materials for more than half of all small boats built in the UK. In the US this figure is even higher. A much larger market has made the production of small boats, even by matched die compression moulding, reasonably economic in some instances.

Ministry Assistance

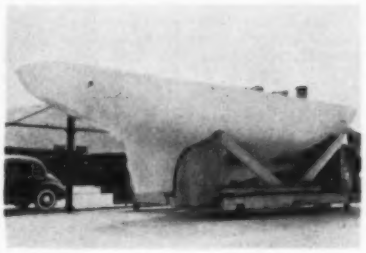
The Ministry of Transport deserves some credit for the part it has played in the development of reinforced plastics for boat-building. The new material was an obvious choice for ships' lifeboats, and the Ministry lost little time in investigating the claims made for reinforced plastics and in taking an active part in its proper application. Thanks largely to Ministry support, about 1,000 ships' lifeboats are moulded in this country every year; modern British liners such as *Oriana* and *Canberra* are equipped entirely with polyester/glass fibre lifeboats.

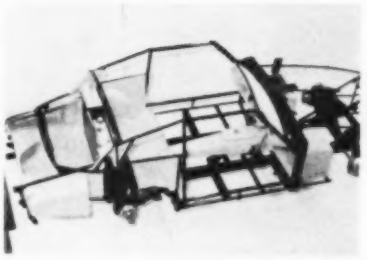
The largest boat hull ever to be moulded in one piece—in fact the largest single piece plastic moulding of any type—was completed in this country last year. This 67ft. hull, moulded by Halmatic Ltd., was ordered by an American company and is being fitted out in the US as an ocean-going cruiser. This illustrates well the confidence placed in this form of hull construction by the boat building industry and gives an indication of future trends in this market.

Complex Curvature Components

The annual Boat Show at Earls Court reflects the increasing interest of the public in boating and also the increasing use of polyester/glass fibre for boat hulls. Dinghies, runabouts, speedboats, luxury motor cruisers, large sailing yachts, all these are now being made in reinforced plastics and present a potential market of some 4,000 tons a year. Apart from hull construction, polyester/glass fibre also finds application on board, where weight saving is of some importance. These are mainly complex curvature components such as ventilator cowlings, air ducting, shower cabinets, swimming pools and the like.

Land transport provides the largest group of applications for reinforced plastics in the transport industry, including as it does railways and associated trades, cars, commercial vehicles, motor cycles, scooters and mopeds. Although the Continent is ahead of British reinforced plastic developments on the railways, the last few years have seen a great improvement.





The products shown are, from top to bottom, a 36-ft. motor lifeboat for *Canberra*, contact moulded by Viking Marine Co. Ltd. Filament-wound sectional road tanker manufactured by A. B. R. Familleureux, Belgium. Halmatic Ltd.'s one-piece moulding for the *Alden Challenger* centreboard yawl. Reinforced - plastic mouldings made by AC Cars Ltd. for the AC 'Greyhound.' Michenall Bros. Ltd.'s 'Avon' streamliner and pannier equipment

Rapid Railway Development

Front and rear roof canopies of many diesel and electric locomotives are now moulded in polyester/glass fibre; complete carriage doors of this material are also in service, gangway shields, bridge smoke guards, station signs and signalling equipment are lesser but nevertheless useful applications of reinforced plastics.

In France reinforced plastics have been used for some years for the construction of complete carriage bodies, and it is known that this approach is being actively investigated in this country. The modernization schemes on British Railways and other improvements and replacements might well use up to 10,000 tons of reinforced plastics per year during the next few years. This figure may be a little optimistic but it does represent a potential market which should not be overlooked.

The first car bodies in polyester/glass fibre were made in this country about ten years ago. Since then there have been some attempts to mass produce car bodies, but it was soon realized that when more than about 2,000 per year were required reinforced plastics had no chance to compete with the conventional sheet metal pressing.

Even if it was economical to produce matched metal tools, the curing cycle of present polyester resins is too long to enable reinforced plastics to replace sheet metal altogether. When production is restricted, however, as it is for special models and racing car bodies, invalid carriages and certain types of three-wheelers, polyester/glass fibre has a definite advantage and will continue to be used. This is particularly true in the commercial vehicle industry, especially for heavy vehicles and special coachwork, where the number required of any one design is low when compared with the car industry.

Sandwich Construction

Complete cabs for lorries are in regular production and are standard for a number of reputable large manufacturers. Many firms have specialized in this field of construction and are moulding complete vehicle bodies for large insulated vehicles using sandwich construction. Public service vehicle operators are becoming conscious of the advantages of reinforced plastics, which do not dent like metal, and find that polyester/glass fibre panels need less frequent replacement. Many coaches,

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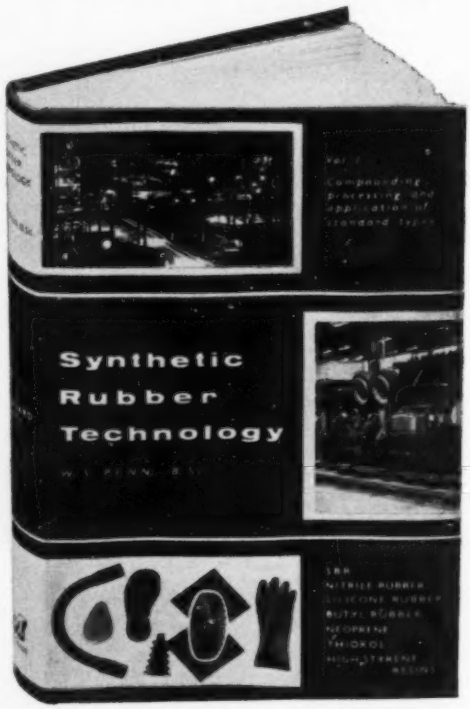

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101 WEST 31st ST., NEW YORK, U.S.A.

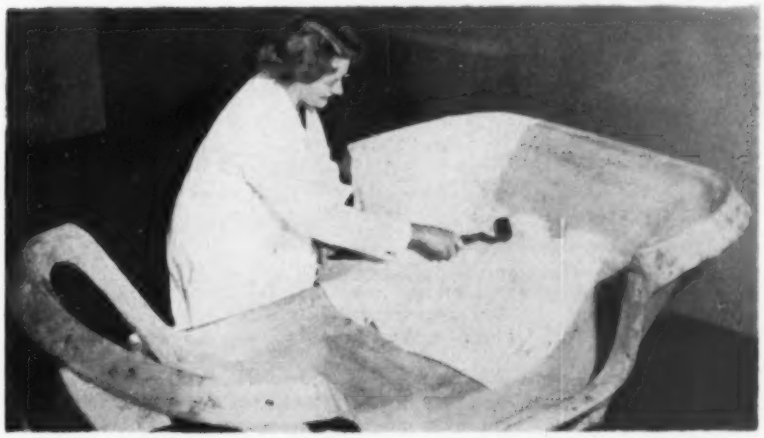
buses and tractors contain reinforced plastics today, and it is estimated that about 65% of all heavy vehicles being made today make use of the material in one form or another.

A prototype single-deck bus is in service which has been constructed almost entirely from large reinforced plastics panels by double skin construction. The builder hopes to show that this type of vehicle will run at lower maintenance cost than similar vehicles made with metal bodies.

More Freedom in Design

The increasing demand for conversions of 15cwt. vans into mobile caravans, mobile shops, ambulances and small public service vehicles is accompanied by a proportional increase in the use of polyester resin. Complete roof units, translucent when required, are being moulded in one piece, and by using reinforced plastics there is a greater freedom in design and the possibility of making modifications without the need to make costly new dies.

An important outlet for reinforced plastics has been, and still is, the use of fairings and streamlines on motor cycles, scooters and mopeds and the construction of sidecars. Large-quantity production of these components has been achieved, using the often derided hand lay-up contact moulding process, by rational lay-out of workshops and proper division of responsibilities. If the 1959 production figures of road transport vehicles can be used as a scale for future requirements, this industry alone could use up to about 40,000 tons of reinforced plastics each year, that is about four times the quantity used in 1959 in all reinforced plastics applications.



Fothergill and Harvey's Lantor-Tygaweb nonwoven fabric being applied as surfacing cloth to a glass-reinforced-plastics car top. The use of nonwovens for the gel coat is said to improve the weathering qualities of a laminate, giving a high resistance to degradation and increasing impact strength

PERCENTAGE USAGE PER YEAR OF REINFORCED PLASTICS IN TRANSPORT

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Aircraft	50	45	40	20	20	15	10	5	4	5
Boats, etc. ..	5	10	10	10	5	15	18	15	20	22
Land transport ..	5	5	5	10	7	15	25	20	25	26

The changing distribution of reinforced plastics in British transport industries during the last ten years is illustrated in the table. The figures represent the percentages of total usage each year. It will be noticed that throughout this time transport applications have accounted for about half of total production.

There are still people who claim that the sky is the limit for reinforced plastics. Of course, this is no more true of reinforced plastics than for other materials. In common with other materials, reinforced plastics have disadvantages as well as advantages. The future of the industry, well organized today within the British Plastics Federation, depends to a great extent on the recognition of the limitations of reinforced plastics, by raw material manufacturers and fabricators alike.

Reaching Maturity

At the moment there is every indication that these versatile materials are being properly used in this country and that the transport industry is recognizing that the infant of ten years ago is reaching maturity. If this trend continues there is every hope that prospects are good and that transport will be an expanding market for reinforced plastics.

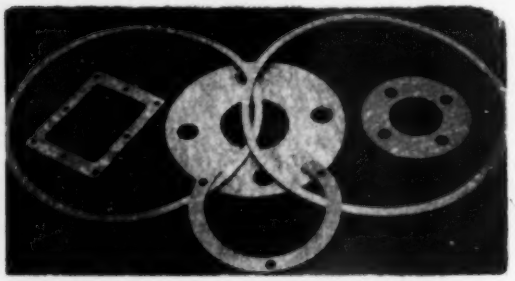
The Dinkum Dumper earth-moving equipment, the cab, bonnet, wings and wing supports of which are moulded in glass-reinforced polyester by Whitlock Bros. Ltd.

Rubber and the USAF

Firestone Tire and Rubber Co. and the US Air Force have signed a contract for continuation of an elastomer research programme for a further year.

Emphasis in this programme has been on high temperature elastomers for such applications as aeroplane tyres. New items will include the preparation and evaluation of new types of elastomers for possible high temperature applications, and studies of the adhesion qualities of high temperature fibre, ageing of rubber under space conditions, and stress relaxation at high temperatures.

Rubber and Plastics in Transport



SBR is used in these gaskets manufactured by Richard Klinger Ltd.

SBR in Transport

POTENTIALITIES OF SYNTHETIC IN NON-TYRE APPLICATIONS

By N. F. WEYMOUTH, International Synthetic Rubber Co. Ltd.

IT is often asked why SBR has not made the same sort of progress in the UK in non-tyre applications in the transport field, as it has in the USA. For example, estimated SBR consumption in the UK in non-tyre applications rose from 7,500 tons to 11,500 tons between 1958 and 1959, but this latter figure accounted for only 10% of the total rubber used outside the tyre industry and contrasted with a figure of about 55% in the USA.

One of the reasons for this low percentage has been the existence of a large number of British Standard Specifications which have either specified the exclusive use of natural rubber, or permitted only a restricted use of SBR, since many of these were drawn up before SBR was available in its present form. Although recent amendments to specifications permit a greater use of SBR — for example in belting and cables — it is expected that this tendency will spread to other applications.

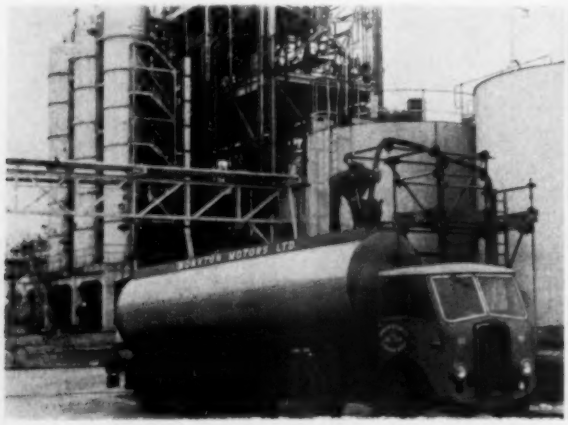
There has also been a certain amount of resistance to SBR because of the fear that it was an inferior product. For this reason considerable emphasis is being laid on technical service by the International Synthetic Rubber Co. Ltd. — a service which is advising customers on the potentialities of SBR and the best way of using it in the manufacture of various products. This service has been successful in showing the considerable versatility of SBR.

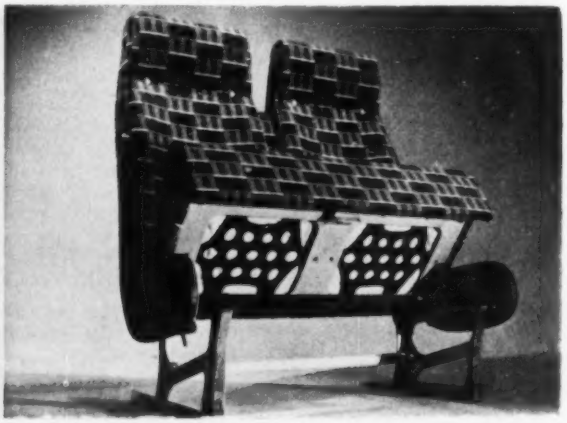
It is undoubtedly due to factors like this that an increase in SBR consumption in non-tyre applications took place in the UK in 1960, and it has been estimated that the usage figure for 1960 was perhaps upwards of 12,000 tons and may easily rise to 18,000 tons in 1961.

When considering rubber in transport one thinks automatically, of course, of tyres, re-treads and tyre sundries and accessories. These particular applications absorb the largest proportion of the SBR produced, but an increasing use is being found in many other products associated with the transport industry in its widest sense. In fact, it could be said that in all forms of transport — from a baby's pram to a space ship — synthetic rubber is being used, and that on land, on sea and in the air, it is an essential raw material.

On the roads themselves the 'cat's eyes' are a constant reminder of the presence of synthetic rubber and, although the use of rubber in road construction does not as yet involve any large tonnage, and still remains in the experimental stage, the potential for both natural and synthetic rubber here must be very substantial indeed. It appears that the addition of rubber to the surfacing does improve waterproofing and wear, and restricts damage done by extremes of temperature, although the test roads which have been laid in many parts of the world will have to be observed over a period of some years before the various claims can be proved.

It is of interest to list some of the applications outside tyres in which it





Synthetic latex being pumped into a bulk tanker at the International Synthetic Rubber Co.'s high solids latex plant (*left*) goes into the Plaxton coach seat made by Vitafoam Ltd. Vitafoam is using blends of 75% NR + 25% SBR and 50% NR + 50% SBR in its upholstery for transport and other fields

is known that styrene-butadiene rubber and latices are being used:

CARS AND LORRIES

Windscreen sealing strips.	Battery boxes.
Fan belts.	Radiator hose.
Heater hose.	Engine-mounting blocks.
Door-sealing strips	Rubber matting.
Steering wheels.	Rubber suspension units.
Weatherproofing compounds.	Anti-drumming compounds.
Brake linings.	Flexible gaiters.
Rubber mudguards.	Seat cushions.
Gaskets.	Adhesives.
Coach and bus seating.	

CYCLES

Brake blocks.	Handlebar grips.

MILITARY VEHICLES

Crash pads.	Track pads.

SHIPS

Fenders.	Inflatable life rafts.
Sealing strips.	Flooring.

SCOOTERS AND MOTOR CYCLES

Saddles.	Handlebar grips.
Battery boxes.	

RAILWAYS

Seat cushions.	Vestibule concertinas.
Rail chair pads. (These are used between the steel rail and the new concrete sleepers being laid as part of the modernization programme.)	Cables.
	Washers in vacuum brakes.
	Window-sealing strips.
	Flooring.
	Buffer assemblies.

AIRCRAFT

Sealing strips.	Interior fittings.

From the above list it will be seen that synthetic rubber is indeed being used in a very wide range of applications in the transport industry apart from tyres, and that the continued development of the transport industry must mean substantial increases in non-tyre SBR consumption in the UK. In due course this may well reach the American percentage mentioned earlier.

It is with this type of progress in view that the ISR plant has been expanded in capacity to meet the increasing demands of the whole of industry for UK-produced SBR of high quality, backed by a well-equipped and forward-looking technical service designed to help solve the various technical problems which such developments may bring.

DU PONT PLASTICS IN TRANSPORT

A one-day seminar has been arranged by Du Pont Co. (UK) Ltd. on plastics in the automotive industry, for which invitations have been extended, mainly to members of the motor industry. One of the main speakers is to be Dr J. D. Young, who is manager of automotive development, Detroit, for the polychemicals department of Du Pont. Several other speakers will discuss various aspects of the subject and a selection of the displays from the Du Pont exhibit at the SAE Exhibition in Detroit will be on show.

The seminar is to be held in London and then in Coventry, and will be followed by similar functions in most European countries.

Housing Relays

Electrical relays in the Douglas DC-8 jet liner are being housed in an Allied Chemical alkyd moulding compound, Plaskon Alkyd 446.

Dracone Progress

5,000 TONNER IN FIVE YEARS?

ONE of the most recent developments in transport is the by now well-known Dracone. This sausage-shaped container has led to a small revolution in the transportation of liquids.

Woven nylon, proofed on the inside with acrylonitrile rubber and coated on the outside with neoprene synthetic rubber is the most suitable material for the Dracone's skin. This was recommended by the materials testing department of the Ministry of Aviation An inch-wide strip of the material, 0.237in. thick, has a tensile strength of 2,000lb./in. The exterior coating of neoprene ensures that the container resists abrasion, flex fatigue, sunlight, ozone, salt water, oil and grease.

It was in 1956 that W. R. Hawthorne, C.B.E., F.R.S., Professor of Applied Thermodynamics at Cambridge University, started developing a flexible, towable container. He began by making models of three-ply rubberized cotton fabric filled with methanol, adding varying amounts of water to alter the specific gravity of the liquid. The initial work progressed to the building of larger 'Dracones,' capable of carrying commercial quantities of the liquid in bulk.

The latest Dracone can carry any liquid that is more than 2% lighter than sea water. There is no need for an air space to keep it afloat and thus no risk of an explosive mixture building up inside. When loaded it has a freeboard above the water level of 22in. and a draught of 63in., carrying a liquid load of 350 tons. When empty it weighs 6.3 tons. Filling is done through one connexion at the tail end and unloading is carried out by suction pump.

The Dracone is constructed by P. B. Cow Ltd. for Dracone Developments Ltd. The neoprene outer coating is put on in layers, using a neoprene-based solvent adhesive.

Carrying Oil and Water

Dracones are now being used commercially in various parts of the world. In the Far East and in Africa's Niger delta they are transporting diesel oil to drilling rigs in remote areas difficult of access. Soon a Dracone will be used for transporting palm oil in Malaya. Yet another is being designed for transporting fresh water to drought ridden islands off the coast of Greece. For these water-carrying Dracones a special neoprene coating compound for use with foods is used for the inner coating to ensure against taint.

The largest model yet built carries 350 tons, but a 1,000 tonner could be constructed today — and it is considered that within five years a Dracone capable of carrying 5,000 tons could be built.

The latest 200ft. Dracone, seen undergoing trials on Southampton Water, contains 100,000 gallons of kerosene

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Plantation Commentary

NO SIGNS OF SERIOUS RIVAL TO NATURAL

by our Malayan Correspondent

FROM KUALA LUMPUR

CONSIDERABLE interest has been aroused here by an optimistic report on the future of natural rubber in the face of competition from the so-called synthetic-naturals by W. G. Wren, head of the chemical division of the Rubber Research Institute of Malaya, who has just returned from a tour of the USA and Canada. He warns against complacency in the natural industry, but his general conclusion is that, given reasonable conditions, natural should be able to undersell the synthetic naturals.

Demand Exceeds Supply

Summing up his report, he says: 'At present there are no signs of a serious rival to natural that could sweep the board and render plantation rubber uneconomic. While the demand for total rubber exceeds supply, it is obvious that Malaya will continue to sell all the rubber she produces.

'If the supply of total rubber should exceed the demand, then natural rubber stands a very good chance of securing a high proportion of the market for natural-type elastomers, since it can afford to undersell any synthetic-natural likely to be available in the near future. This current position, although favourable, gives no grounds for complacency, however. A vigorous research policy is being pursued to advance synthetic rubber and an equally vigorous policy should be pursued for natural rubber.

'Provided continued and well-planned efforts are made in the fields of research, development of new products and technical service to consumers, there is no reason why natural rubber should not maintain its place in the world markets.'

Problems for Tyre Builders

Reporting on his tour, Mr Wren says that cis-polybutadiene has been found to have better resistance to roadwear and more bounce than natural rubber or styrene-butadiene type rubbers which are used to make the bulk of American tyres today. But it has drawbacks and it is not very sticky in its vulcanized state and presents problems for the tyre builders. There is a tendency for the finished tread to chunk out or to chip off in use.

The only solution at present is to use a blend of cis-polybutadiene and natural but work on these problems is by no means completed, and it does not necessarily mean that they will not be overcome eventually.

On cis-polyisoprene, Mr Wren says that this has received considerable research attention in America and Canada. It behaves better in the factory, and it is claimed that it can be used for making 100% synthetic lorry tyres, but it is difficult to produce as a raw material and does not give a tyre that performs as well in service as cis-polybutadiene. He considers that it is somewhat inferior to natural rubber in many other important characteristics.

Ethylene-propylene, he says, is judged to have properties that are distinctly inferior to natural and it is viewed as a potential rival to SBR. It has proved to be a very different raw material to the kind the manufacturers are used to handling. Special chemicals and techniques are required to handle and manufacture tyres and a particular difficulty is that it has very poor 'tack' which presents problems in building such things as tyres and conveyor belts. Mr Wren points out that this rubber cannot be used at all with other rubbers but it does possess excellent resistance to ozone and oxygen.

Reporting on the three rubbers, he says that present plans are to produce in America and Canada within the 'next year or so,' 230,000 tons a year. The types to be produced will depend on the demand. Their characteristics can be varied by the use of different catalysts but further time and money may be required for research in selecting which variation to produce.

Diene Selling Prices

Mr Wren thinks that cis-polybutadiene and cis-polyisoprene are likely to sell for US30 cents a lb. The price can be expected to stabilize somewhere between US25 and US28 cents a lb. when in full production.

Ethylene-propylene rubber is expected to sell for US24 cents a lb. initially and possibly US20 cents a lb. when in full production. This low price is possible because of the very cheap raw materials which can be used but the rubber is not comparable with natural, but with SBR and butyl.

Mr Wren says in his report that there were no hints of any startling new developments in synthetic rubber. One expert suggested that most of the easy rubbers had been examined and that further research in the field of hydrocarbon polymers could now be expected to yield diminishing returns. Another comment had been: 'There is no duplicate for natural rubber yet,' and a third — 'As we learn more about natural rubber, we are surprised to find what a good job nature has done.'

He warns, however, that an enormous research effort is still being made by manufacturers to obtain a material sufficiently close to natural rubber so that natural could be replaced 100% by synthetic rubbers.

'At present they are very close to achieving this and will probably do so within the next year or two,' he says. 'But the price of the new rubbers produced for this purpose will be as high or higher than that of the present general purpose synthetic rubber. Natural rubber selling at US25 cents a lb. should then compete easily with the new stereo-specific polymers. At a slightly lower price for natural rubber, it would appear that synthetic-natural rubbers would become uneconomic to produce.'

Four Combine Interests

The direction of about 120 estates totalling approximately 250,000 acres, has now come under the control of a single agency house with the formation of the Malayan Estates Agencies Group Ltd. Exact acreage figures are not yet available, but the new group, which is settling into two floors of a modern multi-storeyed building in Kuala Lumpur, has been formed by the voluntary amalgamation of the estates interests of four well-known firms — REA and Cumberbatch Ltd., Harper, Gilfillan and Co. Ltd., Whittall and Co. (Malaya) Ltd. and James Warren and Co. Ltd. The fact that this is a voluntary amalgamation has been stressed; there is apparently no question of a take-over bid.

An official of the new company said that the amalgamation had been under discussion for about a year. The initial impetus had come from London from the boards of directors of the various estate companies. He agreed that the need for amalgamation was partly the result of take-over bids and other changes of ownership in London, which had resulted in some cases in boards of directors having to deal with different estate agencies. This had led to complications and waste of effort.

'The new company will simplify procedure for the boards in London and will unify procedure generally, particularly with dealing with the London boards,' he said.

Under the new arrangement the former companies have shares in the new Malayan Estates Agencies Group Ltd. Three of the directors of the group are from REA and Cumberbatch Ltd., including the chairman, D. E. Teale, two from Harper Gilfillan and Co. Ltd. and Whittall and Co. (Malaya) Ltd., and one from James Warren and Co. Ltd. The directors are Mr Teale, R. G. Delves (deputy chairman), J. Paton, F. H. Curtis, J. H. D. Sibree and J. N. Hughes. Most of the 250,000 acres of estates involved in the amalgamation are under rubber but there is also a certain amount of oil palm and copra.

Rubber Markets

LONDON

Prior to the closure of the Singapore market over the Chinese New Year holiday period, the market hardened on short covering, and a dull phase ensued with values sagging under limited buying support. Patchy enquiries for cif parcels found sellers not keen to offer. After the holidays the trend was uncertain in a thin market.

Latest prices are as follows:

No. 1 RSS Spot: 24⅛d.-24⅜d.

Settlement House:

March 24⅛d.-24⅜d.

April/June 24⅛d.-24⅜d.

July/September 24⅛d.-24⅜d.

October/December 24⅛d.-24⅜d.

January/March (62) 24⅛d.-24⅜d.

No. 1 RSS cif basis ports:

March 23⅛d.-23⅜d.

April 23⅛d.-23¼d.

Godown:

March 79¼ Straits cents nominal.

LATEX

Centrifuged 60% latex per gallon in drums, seller, March, April, 13s. 10d., cif European ports. Spot, seller, 14s. 5d. Bulk, seller, d.w. 13s. 9d. Creamed, seller, 13s. 7d. nominal. Normal, seller, March, 11s. 8d.

NEW YORK

The New York rubber market ruled as under on February 20:

DEALERS' PRICES

	US cents per lb., ex-dock	
	Feb. 20	Previous
No. 1 RSS, March ..	28⅛s	28⅜s
April ..	28⅛s	—
No. 2 RSS, March ..	28⅛s	28⅛s
April ..	28⅛s	—
No. 3 RSS, March ..	28⅛s	28⅛s
April ..	28⅛s	—
No. 1 RSS, Spot ..	28⅛n	28⅛n
No. 3 amber blanket crepe, March ..	23⅛n	—

FUTURES—REX CONTRACT

	Feb. 20	Prev. Close
March ..	28.35b–28.50a	28.35b–28.40a
May ..	28.30t	28.20t
July ..	28.10b–28.20a	28.00t
Sept. ..	28.00b–28.20a	27.90b–28.00a
Nov. ..	28.00b–28.20a	27.90b–28.00a
Jan. ..	27.90b–28.20a	27.80b–28.00a

Sales: 3. Tone: Steady.

Futures were very quiet on February 20 and trading was almost at a standstill. The undertone was steady. Physical rubber was also very quiet, buyers showing only negligible interest in offerings. Sellers, however, were not pressing.

SINGAPORE

Quietly steady conditions prevailed throughout the morning of February 20. Interest was centred on March No. 1 RSS. Demand was slow to start after the holidays and upcountry sellers were reluctant to meet the market at the lower levels. There was fair enquiry for thin brown crepe. In the afternoon, fluctuations were small and trading limited. Lower sheet interest was small.

	Malayan cents per lb., fob Malayan ports to open ports	
	Feb. 20	Prev. Close
No. 1 RSS, March ..	79¾–80	80⅛–80⅜
April ..	80⅛–80½	80⅞–81⅛
No. 2 RSS, March ..	79⅛–79⅜	80 –80⅛
No. 3 RSS, March ..	78⅜–79	79⅛–79⅜
No. 4 RSS, March ..	74⅜–75⅜	75⅛–76⅛
No. 5 RSS, March ..	65⅜–66⅜	66⅛–67⅛
No. 1 RSS, Spot ..	79⅛–80	80⅛–80⅛
No. 3 blanket thick remilled crepe, March	63 –64	63½–64½
No. 1 fine pale crepe March	84½–85½	85 –86
2X thin brown crepe, March	61½–62½	61¼–62¼
Tendency:	Quiet.	

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rectangular drums, fob at 159.60d. per gallon.

AMSTERDAM

The Amsterdam rubber market ruled as under on February 20:

	Guilders per kilo	
No. 1 RMA	Feb. 20	Previous
February	2.35½	2.35½
March	2.36	2.36
April	2.36½	2.36½
May	2.36½	2.36½
June	2.36½	2.36½
April/June ..	2.36	2.36

Sales: Nil. Tendency: Quiet.

DJAKARTA

The market was quiet all day on February 20. No transactions were reported.

	Rupiahs per kilo	
	Feb. 20	Previous
Spot No. 1 Priok ..	30.25n	Unquoted
Spot No. 2 Priok ..	29.00n	—
Spot No. 3 Priok ..	27.50n	—
No. 1 fine pale crepe, spot	28.50n	—

CEYLON

The price of No. 1 RSS at Colombo on February 20 was 96 (96) Ceylon cents per lb.

BANGKOK

The price of No. 1 RSS at Bangkok on February 20 was 25.75 (25.75) US cents per lb.

Isoprene in UK

Shell Chemical Co. has announced that development quantities of Cariflex Isoprene rubber are now available for evaluation in the UK.

Patent Specifications

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

Tyre Bead Wire

No. 854,971. Dunlop Rubber Co. Ltd. Application, March 12 1957. Filed, February 26 1959. Published, November 23 1960.

During the moulding of tyres, the cord reinforcement tends to slip round the bead wires producing objectionable characteristics which are particularly noticeable in large tyres.

To overcome these difficulties a tyre having a wire or textile cord fabric comprises an anular bead wire located in each of the beads of the tyre and around which the ends of the said reinforcement are turned. An additional wire circlet of larger diameter, located radially outwardly and axially outwardly of the bead wire and coaxial with it serves to wrap and lock the reinforcement securely round the major portion of the cross sectional periphery of the bead wire. The circlet should be a single wire filament or a strand or cable. It is preferably of smaller cross-sectional area than the bead wire and has an inner diameter slightly larger than the outer diameter of the bead wire so that when fitted over the bead wire it forces the free end of the tyre cord reinforcement around the major portion of the circumferential cross section of the bead wire and up against the portion of the reinforcement extending through the side wall of the tyre from the crown.

Future Events

Institution of the Rubber Industry

Manchester Section.—Feb. 27 at the Engineers' Club, Albert Square, Manchester, at 6.45 p.m. 'Properties and Applications of Chlorobutyl Rubber,' by P. E. C. Davies, A.N.C.R.T., A.I.R.I. (Esso Petroleum Co. Ltd.).

Plastics Institute

North-Western Section.—March 3 at the Textile Institute, 10 Blackfriars Street, Manchester 3, at 6.45 p.m. 'Recent Developments in the Use of Acetal Resins,' by G. F. C. Barrett, B.Sc., Ph.D., LL.B., A.R.I.C. (Du Pont Co (UK) Ltd.).

Rubber Statistics

Due to pressure on space this regular feature has had to be held over. It will appear next week.

Increases of Capital

Straits Rubber Co. Ltd. (162,263). 19 Leadenhall Street, E.C.3.—Increased on June 21 1960 by £250,000 in 2s. shares, beyond the registered capital of £1,125,000.

London Sumatra Plantations Ltd. (657,737). 1 to 4 Gt. Tower Street, E.C.3.—Increased on June 14 1960 by £1,099,900 in 2s. shares, beyond the registered capital of £100. (Changed to public company on June 28 1960.)

Laburn Ltd. (558,441). Plastic fabrication, etc., Burcol Works, Radway Road, Shirley, Warwicks.—Increased on June 24 1960 by £30,000 in £1 ordinary shares, beyond the registered capital of £20,000.

Industry INTELLIGENCE

Technical Data

Plastovac-P

The introduction of Plastovac-P by Storeys of Lancaster was announced in *RJIP* March 19 1960, 432. A data sheet is now available giving details of the properties and applications of the material. Plastovac-P is a hard abrasive-resistant PVC film containing only polymeric plasticizers, which has been specially developed for the vacuum covering of a wide variety of articles to obtain a hard-wearing, hygienic and decorative finish. The material is resistant to a wide range of chemicals and resists staining from most domestic materials with which it is likely to come into contact.

The advantages claimed for Plastovac-P over other PVC sheetings include its ability to retain embossed patterns at the elevated temperatures encountered during the forming operations. The use of polymeric plasticizers prevents migration into the adhesive used to bond the sheet to the article being covered and subsequent lack of adhesion and the elastic recovery of Plastovac-P at normal temperatures is poor, thus decreasing the tendency of the formed sheet to return to its flat state.

Tretol Epiflor

Most factories have 'difficult' floor areas because heavy traffic and spilled corrosive materials often punish floors beyond endurance, necessitating frequent resurfacing. Tretol Epiflor, a new flooring composition developed by Tretol Ltd., is claimed to have proved under testing to be the best material for these floor areas.

Tretol Epiflor is a combination of special resins and aggregate which will adhere to floors, and give a coloured, non-slip topping ¼in. thick, which is resistant to chemicals and acids. Having a good abrasion resistance, it stands wear by foot traffic, trolley and trucking, and can be laid by maintenance staff. Chemical plants and laboratories, where the floors are attacked by corrosive substances, might find Tretol Epiflor of assistance.

More information can be obtained from the manufacturers—Tretol Ltd., Tretol House, The Hyde, N.W.9.

Plastolene Materials

Information sheets on new Plastolene products have been issued by Storeys of Lancaster. Together with samples of the product concerned, each sheet comprises applications of the material, its resistance to harmful chemicals, and tables that denote the material's width, tensile strength, and finished weight.

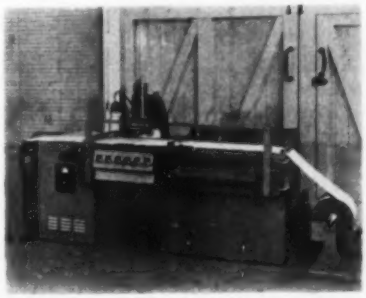
All Plastolene products consist of sheets of plasticized vinyl, bonded together with a reinforcing mesh of Terylene, but these recent products include the heaviest material in the Plastolene range and one of the lightest. The materials are reported as being completely weatherproof and resistant to acids, fats, oils, and the majority of chemicals. Ready for use as weatherproof clothing in out-of-door industries, tennis-court and football-field covers, lorry and lifeboat covers, and for garden and beach furnishings such as cushions and canopies, these materials are available in many colours.

Attention is also drawn, in the tables, to the weight/strength ratio, and its elasticity calls for mention, as this allows the material to 'give' so that strain is not taken at one point but is distributed over an area.

Machines, Materials and Equipment

Junior Autodex

The Junior Autodex is a strip feed mechanism, and it is claimed that when fitted to any of the smaller range of Radyne Plastic Sheet Welders it will make possible fully automatic production of suitable components at a rate of 500-800 per hour.

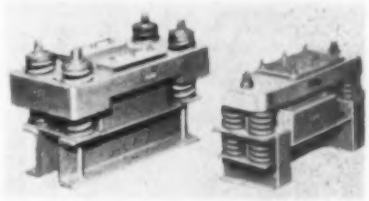


The equipment needs little attention during its run and one operator can mind a number of machines. The machine operates on the pusher principle — the material being pushed through the machine which eliminates any danger of distortion of welds or the accidental separation of tear-seals.

Further information can be acquired from Radio Heaters Ltd., Eastheath Avenue, Wokingham, Berks.

Magnetic Vibrator

An improved design of magnetic vibrator has been developed by Magco Ltd., Lake Works, Porchester, Hants, which is claimed to be more efficient and more economic to produce. The bottom unit, which carries the armature, is comparatively light, whilst the upper moving unit consists of a casting on which is carried the laminations and coil. This reversal of the static to moving weight ratio means that a vibrator of a given weight is more efficient than one of the same weight but of conventional design. A range of vibrators is available, suitable for the smallest pharmaceutical packaging machines to bunkers holding hundreds of tons. The smaller units operate twice per cycle, giving 6,000 vibrations per minute on 50 cycle supply, while the larger models operate on a half wave system at higher amplitude.



Publications

Glycerine Applications

Glycerine News, issued by the UK Glycerine Producers Association Ltd., 5 Bridewell Place, E.C.4, describes new applications of glycerine listed in patent specifications and from other published sources.

Issue No. 25, January 1961, includes news of glycerine used in the production of US urethanes, glyceral monostearate improving heat and light stability of vinyl polymers, and glycerine used as a plasticizer in alginate coatings.

The issue also mentions an article in which the properties and uses of fatty acid methyl esters in the production of partial glycerol esters and alkyd resins are discussed.

EIL Catalogue

For many years Electronic Instruments Ltd., Richmond, Surrey, have specialized in the devising, developing, and manufacturing of *p*H Meters for research and development. Now they have published a fully-coloured catalogue describing the complete range of *p*H Meters. Each meter is illustrated and full details of the model, including its ranges, stability, size and weight, are given.

One page lists well-known firms with their trade-marks, and the catalogue ends with a short article called 'What is *p*H?' which gives a simple explanation, easily understood by the semi-skilled control operator.

A view of the EIL research laboratories is given, followed by notes on design, and a typical installation. On the back cover are shown EIL overseas subsidiaries in France, Canada, and Australia.

Material Prices

Prices of materials appear regularly in RUBBER JOURNAL AND INTERNATIONAL PLASTICS on the last Saturday of each month. It will be appreciated if suppliers will give notification of any price changes and additions to or deletions from their range. Comments on the present materials and classifications are invited in order that the list may be made of maximum service to our readers.

Unless otherwise stated prices are per lb. In most cases prices vary according to quantity. pc—per cwt pg—per gallon pt—per ton ag—according to grade xs—ex-store xw—ex-wharf dp—duty paid sp—special prices for contracts del—delivered cp—carriage paid

Accelerators

Alpha ..... 5s. 8d.—6s. 4d.
Ancap cp ..... 2s. 10d.—3s. 8d.
Ancap Zinc Salt cp ..... 3s. 2d.—4s. 2d.
Ancatax cp ..... 3s. 9d.—4s. 6d.
Ancazate BU cp ..... 6s. 3d.—6s. 9d.
Ancazate ET cp ..... 5s.—6s. 4d.
Ancazate ME cp ..... 6s. 2d.—7s.
Ancazate Q cp ..... 6s. 1d.—6s. 4d.
Ancazate XX cp ..... 5s. 1d.—5s. 9d.
Ancazide ET cp ..... 5s. 9d.—6s. 6d.
Ancazide IS cp ..... 7s. 6d.—8s. 6d.
Ancazide ME cp ..... 4s. 6d.—5s.
Cu.D.D. ..... 9s. 3d.—10s.
D.Bu.D. ..... 10s. 6s.—11s. 3d.
D.D.D. ..... 12s. 2d.—13s. 3d.
D.P.G. cp ..... 3s. 5d.—4s. 2d.
D.O.T.G. cp ..... 4s. 5½d.—4s. 9d.
Dibenzo GMF ..... 27s.—28s. 6d.
Furbac cp ..... 5s.—5s. 9d.
Gamma ..... 10s. 6d.—11s. 3d.
GMF ..... 27s.—28s. 6d.
L.M.D. ..... 9s. 3d.—10s.
M.Z.I. ..... 3s. 6d.—4s. 2d.
N.Bu.D. ..... 10s. 6d.—11s. 3d.
Ni.P.D. ..... 12s. 2d.—13s. 3d.
P.P.D. ..... 12s. 2d.—13s. 3d.
P.T.D. ..... 12s. 2d.—13s. 3d.
Robac 22 ..... 10s.—11s. 3d.
Robac 44 ..... 9s. 1d.—9s. 10d.
S.P.D. ..... 9s. 3d.—10s.
Suparac M ..... 9s. 7d.
T.B.U.T. ..... 15s.—16s.
T.E.T. ..... 6s. 6d.—7s. 4d.
Thiuram P.25 ..... 15s.—16s.
T.M.S. ..... 7s. 8d.—8s. 6d.
T.M.T. ..... 5s. 4d.—6s. 3d.
Vulcacit CZ deldp ..... 7s. 1d.
Vulcacit F deldp ..... 4s. 8½d.
Vulcacit NP deldp ..... 11s. 2d.
Vulcacit P Extra N deldp ..... 8s. 1d.
Z.B.E.D ..... 15s.—16s.
Z.Bu.D ..... 6s. 3d.—7s. 3d.
Z.D.C. ..... 5s. 1d.—5s. 7d.
Z.L. ..... 9s. 3d.—10s.
Z.P.D ..... 9s. 3d.—10s.

Antioxidants and Antiozonants

Agerite AK cp ..... 3s. 6½d.—4s. 5½d.
Agerite HPX cp ..... 4s. 5d.—4s. 10d.
Agerite Powder cp ..... 3s. 7d.—4s.
Agerite White cp ..... 8s. 10d.—9s. 7d.
Antioxidant 2246 cp .. 11s. 8d.—12s. 4d.
Antioxidant 425 cp .... 18s. 6d.—19s. 3d.
Antioxidant SP cp ..... 3s. 8d.—5s.
BLE-25 ..... 3s. 7d.—4s. 5d.
BXA ..... 3s. 6½d.—4s. 5½d.
Naugawhite ..... 4s. 9d.—5s. 6d.
Octamine ..... 3s. 9d.—4s. 6d.
Polygard ..... 3s. 7½d.—4s. 5d.
UOP 88 xs ..... 9s. 3d.
UOP 288 xs ..... 9s. 3d.
Wing-Stay S ..... 3s. 8d.—4s.
Wing-Stay T ..... 4s. 10d.—5s. 6d.
Wing-Stay 100 ..... 10s. 6d.—11s. 6d.

Compounding Ingredients

Barytes ptag ..... £10—£40
Calcium Silicate del ..... 9d.—10½d.
Calcene ptxw ..... £52—£69 10s.
Carbonate, Light Mg. ptsp £97
Carbonate, Actidated Ca. pt .... £28—£30

Carbon Blacks:

Conductex SCF ..... 1s. 2½d.
Continental AMPC ag 11½d.—1s. 4½d.
Continex FEF ag ..... 9¾d.—10½d.
Continex HAF ag ..... 10¾d.—11d.
Continex HMF ag ..... 9½d.—9½d.
Continex ISAF ag .. 1s. 0½d.—1s. 0½d.
Continex SRF, SRF-NS ag 8¾d.—9d.
Dixie 45 GPF xs ..... 6¾d.—7¾d.
Dixie 60 HAF xs ..... 7¾d.—8¾d.
Dixie 70 ISAF xs ..... 9¼d.—10¾d.
Dixiedensed HM MPC xs ..... 11¾d.
Dixiedensed 77 EPC xs ..... 11¾d.
Furnex SRF ..... 9d.
Kosmos 45 GPF ..... 6¾d.—7d.
Kosmos 60 HAF ..... 7¾d.—8d.
Kosmos 70 ISAF ..... 9¾d.—10d.
Magecol 888 cp ..... 7.60d.
Micronex MPC ..... 11¾d.
Micronex W6 EPC ..... 11¾d.
Philblack A. FEF ..... 7d.—8d.
Philblack E. SAF .... 1s. 0¾d.—1s. 1d.
Philblack G. GPF ..... 6¾d.—7¾d.
Philblack I. ISAF ..... 9¾d.—10¾d.
Philblack O HAF ..... 7¾d.—8¾d.
Regal 300 ..... 7¾d.—8d.
Regal 600 ..... 9¾d.—10d.
Statex B. FF ..... 10½d.
Statex R. HAF ..... 11d.
Statex 93 HMF ..... 9½d.
Sterling SO FEF ..... 7d.—7½d.
Sterling V. GPF ..... 6¾d.—7d.
Ukarb 327 GPF xs ..... 6¾d.—7¾d.
Ukarb 340 xs ..... 7¾d.—8¾d.
Vulcan 6 ISAF ..... 9¾d.—10d.
Vulcan C CF ..... 11d.—11¾d.
Vulcan 3 HAF ..... 7¾d.—8d.
Vulcan XXX SCF .. 1s. 2¾d.—1s. 2¾d.
China Clay ptagxs ..... £12—£68 10s.
Factice Dark cp ..... 1s. 0½d.—1s. 7d.
Factice Whitbro cp .. 1s. 3½d.—1s. 11d.
Factice White ..... 1s. 4½d.—1s. 8½d.
Kieselguhr Spanish White ptxs £37 12s. 6d.
Lithopone 30% ptxs ..... £68 10s.
Manosil VN3 pt .... £120 5s.—£150 5s.
Micafine Powdered Mica ptxs .. £67 10s.
Ochre Yellow pcxs ..... £1 19s.
Oxide Light Mg ptsp £245
Oxide Red pcxs ..... £4 3s.
Oxide Titanium 98% pcxs £8 8s
Rutiox CR pcxs £9 3s
Rubber Gen. Gran. Mineral ptxs £35 5s.
Shellac Dewaxed xs ..... 1s. 9d.—2s. 3d.
Shellac Orange xs ..... 2s.—3s. 9d.
Silica Hydrated ptxs £113
Sulphur Manox Insoluble del .... 1s. 9d.
Sulphur Powdered ptdel ..... £20 17s.
Sulphur Sublimed Flowers ptxs £52 10s.
Talc Norwegian ptxs ..... £13 7s. 6d.
Talc Italian ptxs ..... £30 2s. 6d.
Tufknit Durham CS ..... 8½d.—10½d.
White Lead Dry ptdelsp ..... £112 5s.
Whitetex 2 Clay ptxs ..... £45 10s.
Whiting ptxs ..... £5 9s. 6d.—£7 7s. 6d.
Zinc Oxide pcdel £6

Plasticizers and Softeners

Abalyn pc ..... 220s.—271s.
Al Stearate ptxwdp ..... £253 10s.
Bisoflex 102 pt ..... £513—£568
Butyl Ricinoleate ..... 2s. 6d.—2s. 6½d.
But. Ac Ricinoleate .. 3s. 0½d.—3s. 1½d.
Butyl Stearate pt ..... £277—£282
Ca. Stearate ptcp £220
Diallyl Phthalate .... 3s. 11d.—4s. 11½d.
Dialkyl Phthalate pt ..... £221—£222
Dibutyl Phthalate pt ..... £203—£204
Dibutyl Sebacate ..... 5s. 9½d.
DiOA pt ..... £354—£357
DiOS sp ..... 5s. 0½d.—5s. 2d.
DOA pt ..... £414—£420
DOP pt ..... £276—£277
DOS sp ..... 5s. 7½d.—5s. 9d.
Disobutyl Phthalate pt ..... £196—£197
Diisooctyl Phthalate pt .... £221—£222
Dinonyl Phthalate pt ..... £211—£212
DNS sp ..... 5s. 2¾d.—5s. 4½d.
Ester Gum pcag ..... 130s.—150s.
Flexol 3GO ..... 4s. 8d.
Hercolyn pc ..... 242s.—294s.
Lankroflex ED3 ..... 3s. 2d.—3s. 2¾d.
Lankroflex 29 pt ..... £216—£217
Lead Stearate ptxwdp ..... £223 10s.
Methyl Ricinoleate .... 2s. 4d.—2s. 4¾d.
Me. Ac Ricinoleate .. 2s. 11½d.—3s. 0½d.
Polyglycol Oleate 400 pt £285
Reomol D79A pt ..... £354—£357
Reomol D79S sp .... 5s. 0½d.—5s. 2d.
Reoplex 100 sp ..... 6s. 1½d.—6s. 2¾d.
Reoplex 110 sp ..... 5s. 10d.—6s. 5½d.
Reoplex 220 sp ..... 5s. 6½d.—5s. 8d.
Reoplex 300 sp ..... 7s. 2d.—7s. 3½d.
Reoplex 400 sp ..... 4s. 2½d.—4s. 4d.
Rosin Oil pgag ..... 8s.—18s.
Triphenyl Phosphate pt £366
Tric esyl Phosphate pt £233
Trixylyl Phosphate pt £200
Zinc Stearate ptdel ..... £220—£230

Solvents and General Chemicals

Acetic acid ptdel ..... £77—£100
Acetic Anhydride ptdel £128
Acetone ptdel ..... £75—£120

Alcohol:
Absolute 74.5 op pgdel 4s. 0½d.—4s. 4¾d.
Butyl pt ..... £132—£193 10s.
sec-Butyl ptdel ..... £128—£168
Ter-Butyl ptdel ..... £172—£195
Isopropyl Tech. 99% pgdel 5s.—6s. 5½d.
Butyl ' Carbitol ' pt £283
Butyl Acetate pt ..... £159—£217
Caprylic Acid ptdel £395
Carbon Bisulphide ptxs ..... £71 10s.
Carbon Tetrachloride pg .. 12s. 4d.—20s.
' Cellosolve ' Acetate pt £250
Cresol m- 98% del ..... 4s. 9d.
Cresol o- 30/31°C. del ..... 1s.
Cresol p- 34/35°C. del ..... 5s.
Ethyl Acetate pt ..... £131—£189
Formaldehyde ptdel £40

Glycol:
Diethylene pt £158
Ethylene pt £132
Polyethylene 200 pt £214
,, 300 pt £214
,, 400 pt £214
,, 1,500 pt £264
,, 4,000 pt £274
,, 6,000 pt £294
Isopropyl Acetate pt ..... £126—£184
Isobu yl Acetate 80% pt .. £126—£185
Lauric Acid ptdel £273
M.E.K. ptdel .... £134 10s.—£143 10s.
M.I.B.K. ptdel ..... £166—£209

Methylated Spirits pgdel:
Industrial 61op .... 5s. 5½d.—7s. 2d.
,, 74 op .... 6s. 3d.—7s. 11½d.
' Q ' grade 68 op .. 8s. 5½d.—10s. 5d.
Pyridinised 66 op .. 5s. 10d.—7s. 6½d.
Denatured Methanol 3s. 9½d.—4s. 10d.
Monoethanolamine pt £252

Naphtha Coal tar pg:
Heavy 90—190 ..... 4s.
Light 90—160 ..... 5s. 1d.
Palmitic Acid ptdel £147
Phenol pldel ..... 1s. 4d.—1s. 7d.
Pyridine pg ..... 16s. 6d.
Stearine ptag ..... £108—£130
Toluol Pure/Nitration pg ..... 5s. 8d.
Toluol 90's pg ..... 5s.
Triethanolamine pt £224
Xylol 2/30 pg ..... 5s. 9d.

R·J·I·P· CLASSIFIED ADVERTISEMENTS

APPOINTMENTS VACANT

6d. a word, Minimum 12/6 Box 2/-

SENIOR RUBBER TECHNOLOGIST

required by

Redfern's Rubber Works Limited.

Suitable applicant should be aged 30/35 and have had considerable experience in the production and design of components for the motor industry. The salary will be appropriate to the position.—Applications to the Works Director, Redfern's Rubber Works Limited, Hyde, Cheshire. (854)

CHEMIST required for an expanding company in Manchester area. Candidates should be at least 25 years of age, and possess a minimum of Inter.B.Sc., or an equivalent qualification, with sound industrial background. Experience in polyurethanes desirable but not essential. Own staff informed.—Apply stating full particulars, including present position and salary to Box 839. (839)

CHEMIST or technician required for general works control and development in department manufacturing extruded film. Practical experience in the extrusion of thermoplastics essential. The factory is pleasantly situated in North-West Kent. Good salary according to qualifications. Staff pension fund is in operation.—Full details of education and past experience to Box 846. (846)

ENGINEER wanted to assist in development work at rubber and plastics factory. Age 23/27 preferred, with drawing office or machine shop experience. O.N.C. or studying. Factory now in Hertfordshire but accommodation available when move to East Anglia completed late 1961.—Details of qualifications, experience, and salary required to Box 856. (856)

FOREMAN required to take charge of rubber moulding shop. The department is engaged in the manufacture of mechanical goods and knowledge of rubber/metal bonding is desirable.—Write stating age, present salary and full details of previous experience. Howard Clayton-Wright Ltd., Wellesbourne, Warwick. (858)

P.T.F.E. Mechanicals Production. Midlands manufacturer has unusually attractive opportunity for a man with experience and initiative to take complete charge of newly formed and expanding division in an enterprising company. An excellent salary will be paid to the right man. Our staff are informed of the vacancy and all replies will be treated in absolute confidence.—Box 843. (843)

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required by

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APPOINTMENTS VACANT

(continued)

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SEALS. If you have had experience in production or development in any aspect of seal manufacture and want opportunity to work on your own initiative and expand with a progressive company, we will be able to use you. We have an excellent pension scheme and good salaries will be paid.—Write in confidence to Chief Chemist, B.A.L. Limited, Oakeywell Street, Dudley, Worcs. (844)

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Applications are invited for the following vacancies:

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Personnel Department

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(continued)

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(857)

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(continued)

TECHNICAL superintendent required for substantial rubber company in the Midlands. Good salary paid to man of first-class experience in all aspects of manufacture of mechanicals and extrusions. Please send full details of positions held and salaries paid. Only men of proved experience and capability should apply.—Box 836. (836)

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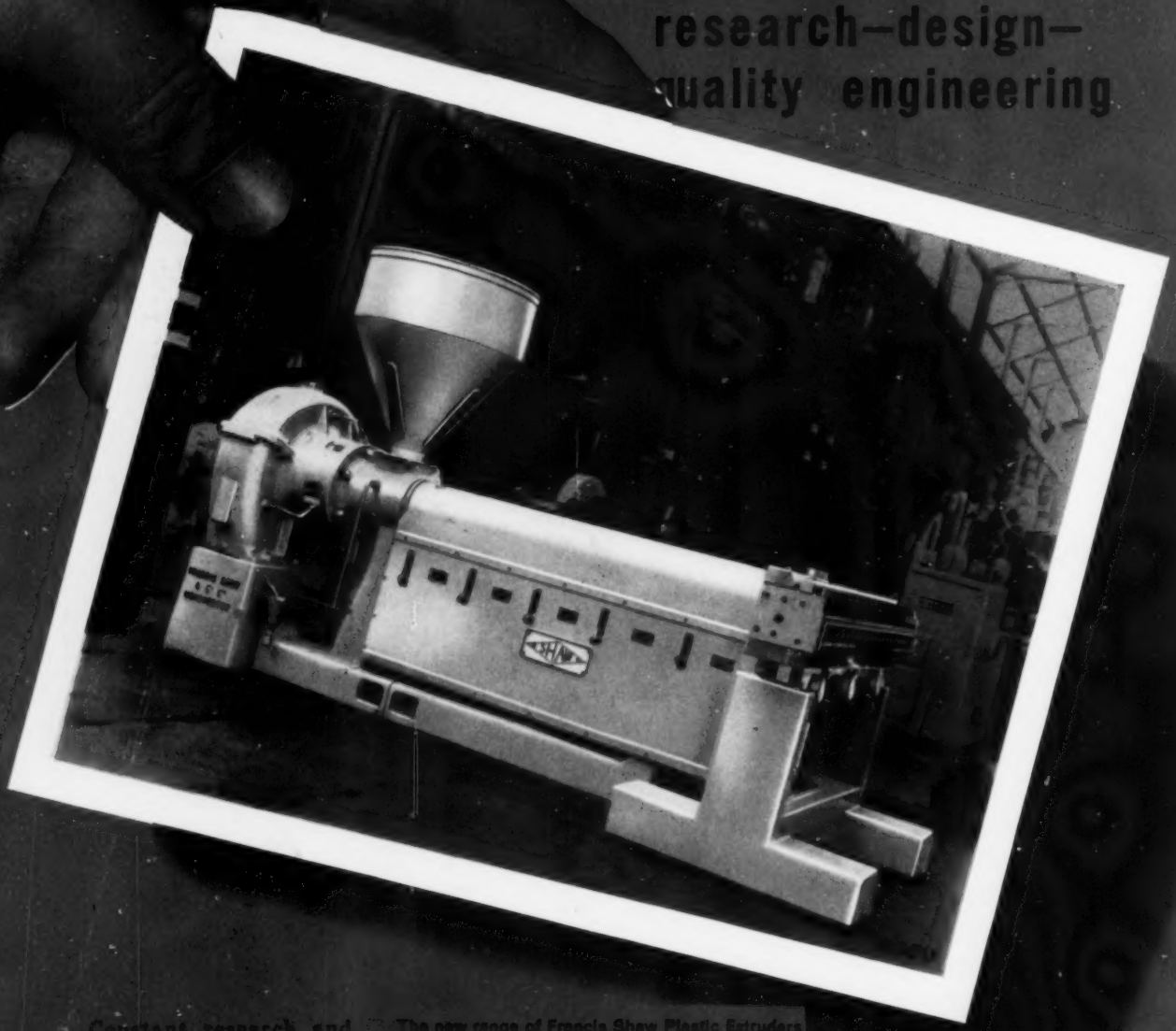

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